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The ELECTRICAL REVIEW

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See p. xl.

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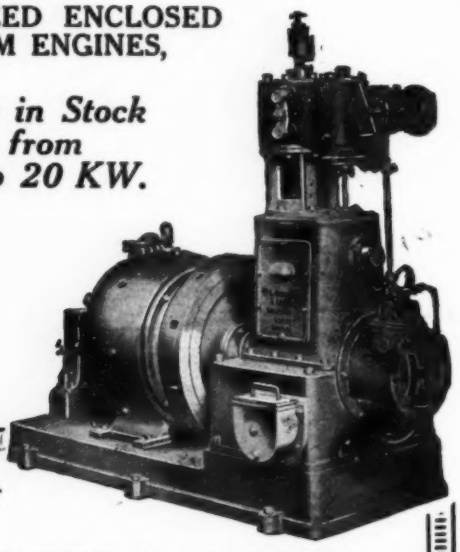

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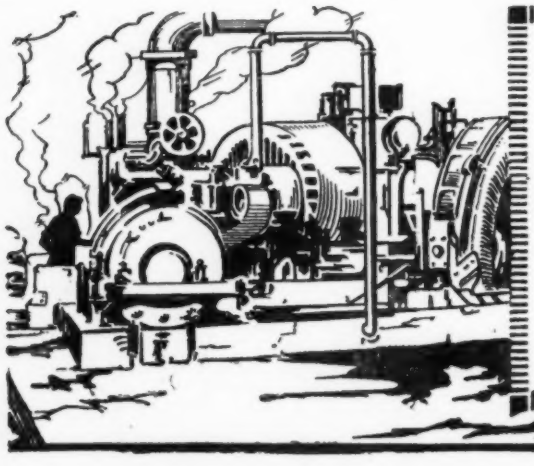

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The

Electrical Review

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The X-ray Examination of Castings.

THE examination of materials by radiation is a very familiar process, and it is somewhat surprising that this method of inspecting castings has not been more generally adopted by foundrymen or engineers for discovering the cause of defective castings, or indeed endeavouring to find whether they are defective before incurring machining expenditure. It is not an uncommon thing for a steam cylinder or similar casting to be not only machined but tested and passed, and yet in a short time it will become porous or crack. A small hole on the surface of a casting is sometimes a means of detecting a large internal cavity. We have seen a bronze propeller, the blades of which had been machined, condemned because a small hole in the bore of the boss indicated that the boss was hollow, and further investigation proved that it was a mere shell.

It is not uncommon for a casting which is apparently sound to fail in service. A test bar may have been thoroughly satisfactory and the casting without apparent flaw. Every precaution may have been taken by the foundryman to ensure that joinings of thick and thin walls of metal have no incipient fractures. The mould may have been made to allow of the easy release of occluded gases, and chills may have been placed at thick sections—and yet a casting may prove defective in service.

Foundry work can never be an exact science, and it is just because of this that the general adoption of the X-ray method of examination would be of inestimable value. It has been because of the uncertainty in the past with regard to castings that designers have so often

favoured forgings, although they are more costly. It is not an uncommon thing for a steam cylinder or similar casting to crack after a short life because of internal stresses that would have been apparent had an X-ray examination been made. Steel castings may show a good surface and yet be porous just under the skin, and this can readily be proved by the examination of a number of steel castings before and after they have been machined. While the X-ray cannot improve bad castings—or welds—yet the prospect of the discovery of flaws ensures that proper methods are adopted to secure good results.

The range of usefulness of the method is, of course, at present limited. The thickness of the metal which can be examined in this way depends on its density. The limiting thickness has not, as far as we are aware, been agreed upon by research workers. Some claim to be able to detect small defects in four inches of steel, while Coolidge, we believe, considers that it is practicable to make use of X-rays in the examination of steel having a thickness of not more than one inch. With this thickness small internal imperfections can be seen, but with greater thicknesses only fairly large blowholes are visible. As the penetrating power of the rays available increases, this maximum thickness will increase, but there is probably a limit to which it can be carried.

Blowholes are not as dangerous as porous patches because they are more easily detected. A "weeping" casting may be the result of various causes and, for hydraulic work at any rate, is quite useless. In an X-ray photograph porous parts are clearly defined, being lighter than the surrounding metal. The fact that different qualities of metals are distinctly shown by a difference in shade demonstrates the success or failure of an alloy, clearly showing if there is a lack of homogeneity, and this characteristic is also valuable in discovering whether core irons or chaplets have been cast in work. Chaplets are usually a source of weakness, and foundrymen do not generally use them when instructions against their use are given, but not all are scrupulous.

The inspection of castings is a necessity, and is usually costly. With repetition work it is customary to test a percentage of the castings—some of them to destruction—and this affords a fair indication of the quality of the metal, but there appears to be every reason why all engineering firms that order large numbers of castings should adopt the X-ray method of examination.

Publicity and Trade.

In response to an invitation extended by representative commercial and industrial organisations in the United Kingdom, a great international convention of advertising men is to be held at Wembley in July next. It will follow immediately on the heels of the World Power Congress, which closes on Saturday, July 12th. On the Monday thereafter such a gathering of advertising interests as has never before been held in this country will be opened. British business, advertising and newspaper men will assemble in force to play the part of host, and they will have no light task to perform during the five days of the convention. From the United States an army of delegates 1,500 strong is expected, while others will come from France, from Belgium, Sweden, Holland and Spain. They will have an opportunity of fraternising amongst the biggest collection of British products that has ever been brought together. Incidentally, there will be some oratory—where would advertising men be without that gift? Our visitors, if they have time between the talking, will see something of the exhibits—we mean the serious manufacturing and trade displays, and a most useful interchange of ideas should take place with reference to the better marketing of our products. The Associated Advertising Clubs of the world who are organising the convention have their headquarters in the United States, but wherever they hold their annual gatherings, the atmosphere becomes highly charged with publicity influence. The promotion of truth and honesty in advertising is a worthy objective, but that is only one of many desirable ends in view. The improvement of merchandising methods, the increase of efficiency in sales promotion and organisation, the extensions of sales by means of publicity and advertising of all kinds—these are important matters for every business that has anything to sell, and however much we may feel that Britain is different from the United States in its taste in advertising, we cannot ignore the fact that advertising and selling across the Atlantic have been brought to a high state of efficiency when appropriately applied to American conditions as the outcome of the activities of the Associated Advertising Clubs.

It is frequently brought home to us that advertising has not yet found its proper place as a means of extending British trade and industry. More and more the buyers in different countries are making a study of the trade and technical Press using it as a guide when making purchases, but our correspondence is almost ludicrous at times in the requests that it contains for the addresses of firms whose names are really household words. Inquiry proves that the reason for this is that the said firm's advertisement figures once a fortnight or once a month in our pages, and in the other numbers cannot be found by the reader. Now one of the objects with which this convention is being held here, so far as the British delegates are concerned, is to make more widely known the resources of the British Empire. It is also intended to demonstrate the excellence of British goods and British craftsmanship, to extend British markets throughout the world, to improve the methods of marketing our products, and to organise British advertising as a selling service to a higher pitch of efficiency. Some manufacturers and traders know from profitable experience already what these advertising men have to say regarding the immense business that has followed a courageous publicity policy. We could quote a large factory manufacturing a certain class of electrical device which grew in a very small space of time from a little workshop with a few hands as a result of persistent advertising in the ELECTRICAL REVIEW in the day of small things. A demand from a foreign country sprang up exclusively as the result of that advertisement and the factory operates to-day on a large scale. It forms one of the most impressive examples that has voluntarily reached us of the value of persistent and telling co-operation between the Press and the manufacturer in increasing foreign trade.

Many such points as the foregoing will come before next July's convention, and we hope that publicity men connected with the electrical and engineering and allied trades will profit from the proceedings so that British traders may use the most up-to-date and most efficient weapons in demonstrating their products in the Press.

Argentine Finance.

It would seem from the recent report on economic conditions in the Argentine Republic, by H.M. Commercial Secretary, at Buenos Aires, that the British Financial Mission which is visiting Brazil might do a great deal of good by going on to the more southern republic. There is evidently considerable need for the adoption of a more consistent and far-sighted policy in financial and economic affairs than has yet been framed by either the existing Government or former Governments in Buenos Aires. British capitalists have ventured much in South American railways, electricity undertakings, and other public enterprises. In more than one of the South American states they have found the authorities slow in recognising that those who risk their money have a right to reap a reasonable reward. There is, however, good cause to hope in the case of the Argentine railways and the Anglo-Argentine tramways that after a protracted period of anxiety, this just principle has been conceded. Mr. Chalkley considers it unlikely that there will be a re-

newal in the near future of the pre-war investment of British capital in railway extensions, presumably because of the new policy according to which the State proposes to do its own construction, instead of delegating the work to private enterprise. Yet much material will be needed, and no doubt the firms offering the most favourable terms of payment will have the best prospect of obtaining the orders. It is evident from the Commercial Secretary's report that many other engineering schemes are mooted, and that in their execution the co-operation of British firms will be mutually desirable. The Argentine Government must, however, smooth the way. If, in seeking to balance its budget and wipe out past deficits, it unduly hampers enterprise, the result will be a decrease rather than an increase in revenue and a general retardation of progress. There are complaints that legislation is too restrictive, that it is ill-considered, and that the business community is kept in the dark both by delay in publication and also by obscurity in the wording of the measures. Some, if not all, of these criticisms apply to the new customs tariff. Mr. Chalkley's comments on the danger of undue interference with the natural course of trade are very sound, and might well be taken to heart by the Argentine Government. He points out that the United Kingdom is the leading country supplying imports to the Argentine, and also by far the largest consumer of Argentine produce. Restriction of imports by excessive customs duties or other means diminishes employment in the United Kingdom and, therefore, the consumption of Argentine foodstuffs, while, on the other hand, the more imports from the United Kingdom are increased the greater will be the demand from the working classes and their families for Argentine meat and wheat.

The Squirrel-cage Motor.

DURING recent weeks a lively correspondence has been proceeding in our pages on the subject of squirrel-cage motors, and the restrictions placed upon their use by various supply authorities. It appears that in many areas the squirrel-cage motor is practically ruled out, except in sizes below 5 h.p., but the fact that elsewhere such motors are permitted without restriction even up to 100 h.p. and more is good evidence that their use is not necessarily detrimental to the public service, and we are confronted with the alternatives either that the restrictions complained of are not founded on a sound basis, or that the system of supply in vogue where such restrictions are thought necessary is inadequate to cope with modern requirements. Of these we are convinced that the former is the right view to take; the nervousness with which some supply engineers nurse their lighting service is reminiscent of the early days of the industry when lighting was the staple and power the rare exception. Those days we have left far behind us; the virtues of electric lighting have long been beyond dispute, and though there is still a vast lighting field for development, the supply authorities are laying themselves out for the development of power, heating, and "other applications" of electricity, the demand for which should enormously exceed that possible of attainment with lighting supply.

We refuse to believe that the mains laid down in large towns are so inadequate, and the sub-stations so far apart, that the lighting service is materially affected by the starting of a 10- or 20-h.p. motor on the outers of a three-phase system; the fact is that the restrictions that we refer to are out of date, and ought not to be allowed any longer to obstruct the path of progress. As we pointed out some weeks ago, that path is always beset by loiterers who are unable or unwilling to keep the pace set by the more enterprising and up-to-date, and thus the industry is handicapped. Incidentally, we may remark that where these restrictions are in force the authorities do not always act consistently with their purport; for instance, so jumpy a load as an electric arc furnace may be found at work on the same premises where a 10-h.p. s.c. motor is taboo, or a large synchronous machine be innocently approved, although in point of fact it starts up as a squirrel-cage motor.

The case for the motor was admirably stated by one of our correspondents recently (Jan. 25th, p. 133): 'The squirrel-cage motor, with star-delta starter, cheap, trouble-free, and ideal in every case where starting torque permits, should be looked upon by the chief engineer as his greatest asset, and not as a menace to his supply system." That is the plain fact.

There is, of course, one valid objection to the squirrel-cage motor—that it will not start on a heavy load without an excessive current; but in most cases the point does not arise, and when it does, a centrifugal clutch which enables the motor to be run up to speed before taking the load will often suit the conditions. As regards efficiency, power factor, and cost, the squirrel-cage type has the advantage.

The undertakings to which we have referred above are of old standing, and some of them may not yet have shaken off the chains of tradition and established practice. Some excuse may be found for them—but it was somewhat of a shock to learn recently that a similar complaint had been lodged against the management of the British Empire Exhibition. We shall all go to Wembley, with visitors from every corner of the world, to see the newest products of British manufacturers and the very latest practice of British engineers—yet, it is said, we shall find the 5-h.p. squirrel-cage motor rule in full force there, exercising a material influence and providing a puzzle for over-sea visitors. Electric power will, of course, be extensively employed in all parts of the Exhibition, and manufacturers are lending hundreds of motors, free of charge, to industrial and other exhibitors to drive all kinds of machinery; unless slip-ring motors are used for all sizes above 5 h.p., we are informed, the users will have to pay heavily for special services. Surely this is a reactionary policy which will bear very heavily upon makers and users alike, and will produce a most unfortunate impression on visitors from countries where the merits of the squirrel-cage motor long ago attained full recognition. The largest and most up-to-date exhibition on record ought to be provided with the most adequate electric service, free from such restrictions, which have even less justification than in public supply. We feel that it is of the utmost importance that motor manufacturers and users should be completely at liberty to adopt such methods and machines as they consider to embody the best modern practice, and we trust that the B.E.A.M.A., members of which are supplying the generating plant for the power house, will take steps to ensure that its other members who are supplying motors shall not be penalised by enforced compliance with an obsolete rule.

Imperial Wireless Telegraphy.

THE announcement that the Postmaster-General has appointed a committee to consider the policy to be adopted with regard to the Imperial Wireless Services will be cordially welcomed by all who are interested in the promotion of closer relations between the Home country and the Dominions. We trust that no time will be lost in ascertaining and publishing the facts, so that the public may form its own opinion regarding the deadlock which has been reached by the Post Office and the Marconi company, and that a solution of the difficulty may speedily be found. The present position is intolerable, and the loss of time that has resulted from the inability of the parties to come to terms is a public scandal. It is most unfortunate that the progress of long-distance wireless telegraphy in this country should have been continually obstructed and delayed by political and other controversies throughout its history. "Enough of this foolery," as Sir Henry Campbell-Bannerman said; let an end be made of bickering—we must have the Imperial service, and quickly.

The Liffey Power Scheme.

By R. N. TWEEDY, M.I.E.E.

THE period of gestation—the interval between conception and birth—for a mouse, leaving mountains out of question, is a few weeks, of an elephant, 20 months, and for an idea . . . . Ah! In Ireland we suffer from contraception of ideas. 'Tis as well in a way, but we do suffer for it many times in a century.

It was not in the natural order of things that the country should be almost completely denuded of forests to feed blast furnaces and other contraptions before coal was used, and there was an idea that the climate, the temperament and the health of the people, and the wealth of the country, would be improved by re-afforestation. Yet the hill-sides and the plains are less wooded than at any time in history.

There was an idea that native coal ought to be mined in the fields of the Four Provinces, and at various times knowledgeable men have explored the attractive possibilities. Yet, to-day, there is less coal hewn than there was 70 years ago.

In the first decade of the 19th century, every bog over 500 acres in extent was surveyed, and one of the most memorable reports in the history of reports was issued by the Bogs Commissioners, showing how all the swamped and useless acres might be drained and brought into the asset side of the nation's capital account. Yet, to-day, there are three million acres of the deepest peat bogs in the world waiting for an idea to condense into action.

As the nineteenth century waned the waterwheels of the 17th and 18th centuries ceased their splashing beat, the mills they drove fell into uninspiring ruins, and waterpower became again an idea. The reasons for these things are to be found in the realms of politico-psychological research, and are not open to discussion in these columns.

The birth of the Irish Free State has brought some of these ideas nearer delivery than they ever were before, but the contraceptionists are by no means dead. Their dark acts will be tested first of all in the matter of water power, which stirs more vigorously than peat or coal at the moment.

Several Commissions have done their part in demonstrating that there is enough water power in Ireland to make her industries independent of imported coal, and it is a fortunate circumstance that one of the most attractive sites of them all is situated some 13 miles from the capital city. A city not yet famous, it is true, for many important industries, but one which is ready to absorb the whole of the energy available from this source if the price at which it is offered is sufficiently attractive.

That the proposition is not without merits is indicated by the eagerness with which three private groups and the Corporation of Dublin are pursuing it. Probably by the time this article is published four private Bills will have awakened the Government to the absurdity of the position, and will hasten the inevitable legislation bringing Ireland into line with the numerous countries which have worked out more or less satisfactory methods for developing natural resources upon rational lines.

Clearly, no popular assembly such as the British Parliament, or the Congress of the United States, or the Oireachtas of the Free State is competent to pass judgment upon the engineering merits of a single proposition to develop power from water or peat or coal, to say nothing of deciding between the claims of four concession hunters. The Assembly, wherever it is, must be guided in all technical matters by persons familiar with the subject in question, leaving to itself the duty of deciding upon the political aspects, such as the greatest benefit to be obtained by the community at large, the possible revenue accruing to the treasury, the extent to which the State should identify itself with the development of its natural resources, and so on.

The action of the Free State Government in this matter of the Liffey must be of far greater moment than most people in Ireland realise, and it is particularly fortunate that the question arises in such an aggravated form, and as affecting the capital itself rather than the districts which would be served by the falls of the Shannon, the Barrow, or the Erne.

It is unfortunate, on the other hand, that the Government was not able to forestall the question, and does not seem even now prepared to deal with it. At a moment when unemployment is not only a private calamity but a national danger, it will not be possible to employ several thousand labourers upon the Liffey works, because the Government must take time to consider the root problem of the relation of the State to such proposals in general before it proceeds to spend more precious time upon the particular proposal over which the whole question has been raised. In the end it will do what should have been done better when it became evident that the stage of talking was over and real work upon water-power development on a large scale was within easy reach.

Fig. 1.—Sketch Map of Liffey Hydro-Electric Scheme.

Whether it might or should have been done, and whether it could have been done under the conditions which prevailed in Ireland since the Treaty was signed, it would be interesting to discuss, but the answers, if there are conclusive answers at all, would not take us any farther upon the rather fascinating road we are to travel.

The River Liffey is interesting in itself. Rising in beautiful high moorland scenery 14 miles from Dublin, it wanders through the country for 74 miles before reaching the sea. Why it did not go to Cork is not known. Its source is 1,715 ft. o.d., and it falls to 550 ft. o.d. in the first 19 miles. There or thereabouts three of the schemes propose the construction of a reservoir to store five thousand million gallons, from a drainage area of 180 sq. miles, and to supply water to one or more power stations, according to the fancy of the promoter, under a total fall also varying from 160 to 220 ft. Poulaphouca and Golden Falls are the names of the two falls at this upper site.

and Salmon Leap at Leixlip, seven or eight miles from Dublin, is the other site, at which a daily pondage supply will serve a fall of from 57 to 64 ft. according to the scheme.

The only complete engineering report available up to the time of writing is one made by Herr Buchi, of Zurich, on behalf of the Dublin Corporation. It is a document of great interest, translated with much ability by Mr. L. J. Kettle, city electrical engineer. It may be taken as an accurate representation of the facts of the case which must be accepted within narrow limits as the basis of any scheme which involves the complete control of the river.

The map accompanying this article has been taken from a pamphlet issued by the Anna Liffey Power Development Co., Ltd., but it serves to illustrate all the proposals with slight modifications in each case.

The Liffey is a remarkably "flashy" river, the upper catchment being for the most part a steeply inclined impervious area off which water flows quickly into the river. The rainfall over the higher lands is said to be nearly twice as great as over the lower parts of the basin, and dry periods are frequent both in winter and summer. Hence, although the effective fall at Ballymore Eustace is considerable, and the mean annual flow at that fall works out at an attractive figure, yet the conditions require large storage to equalise the wet and dry seasons, and wet and dry years. The key of Herr Buchi's scheme is, in fact, the provision of an artificial lake, with a surface of about 5 sq. miles, by which the river is to be brought as nearly as possible within perfect control. This can be done at small expense so far as the dam is concerned, for it will be no more than 80 ft. long at the base, and not more than 250 ft. on the crest at a height of 100 ft. The base will be proportioned to permit the height to be increased by some 10 ft. if control is imperfect at the lower level. An exact determination is not possible at present in the absence of long-period hydrometric data, and it is that lamentable deficiency for every watershed in Ireland which will either hinder development or lead concessionaires into a maze of troubles.

The dam would be built at first up to 605 ft. o.d., and 4,245,000,000 cu. ft. will be available between the 580 and 605 marks; but in general it is believed that storage of the requisite quantity with the intake at the 545 mark will be obtained with the water level below the 595 mark.

The head is estimated at 217 ft., of which the reservoir accounts for 80 ft., the Poulaphouca Falls for 102 ft., and the Golden Falls for 35 ft. This head is to be used in one station at Ballymore Eustace by means of pressure tunnels and two reinforced-concrete pipe lines of 9¼ ft. diameter.

At the Leixlip power site great storage is out of the question, nor is it necessary under the regimen proposed. A dam 60 ft. high will give a head of about 64 ft., and a pondage or daily reserve of 28 million cu. ft. This amount of storage is required if the two stations are to deal with heavy loads simultaneously, for the water from the upper station takes about 18 hours to reach Leixlip. During dry periods when the intervening gathering ground yields little water, the Leixlip station would be stopped at night, and would work at full load next day on the supply sent down from the turbines at the upper station. During wet seasons the Leixlip station would operate at full load day and night to reduce waste over the spill-way to a minimum, and the main reservoir would hold up the flood from the upper catchment area.

The Ballymore Eustace power station would be equipped with five sets rated at 4,500 h.p. at the turbine, of which one set would be strictly stand-by. Hence the maximum output of that station at full-load rating would be 18,000 kW at 92 per cent. efficiency.

At Leixlip there would be three sets each of 3,500 turbine h.p., or 2,400 kW at the alternator terminals, and here no spare plant would be needed because of the reserve at Ballymore Eustace, and at the existing steam station in Dublin. The total full-load rating of the two stations would be, therefore, 19,200 kW.

The guaranteed efficiencies of the turbines are:—For the 4,500-h.p. turbines, 83 per cent. at full load, 84 per cent. at 0.75 load, and 78 per cent. at 0.5 load. For the 3,500-h.p. machines, 82 per cent, 83 per cent., and 78 per cent. All the turbines would be of the vertical Francis type directly coupled to alternators generating 3-phase current at 50 cycles, 5,500 volts, having a total maximum continuous rating of 26,900 kVA.

Transmission would be effected at 50,000 volts by overhead lines carried on steel masts. One line is routed direct from Ballymore Eustace to Dublin (Dolphin's Barn), and another would go first to Leixlip and thence to the common transforming station at Dublin.

This scheme was estimated to cost in November, 1922, £1,130,000, of which the Ballymore Eustace station accounts for £740,000, Leixlip station for £270,000, and transmission lines £120,000. The main reservoir and dam are put down at £230,000, of which a large part presumably is earmarked for land purchase, and compensations of all kinds. It appears, therefore, that the capital cost per effective kW installed is £58 at the main site, £38 at the secondary site, and £53 over all.

Herr Buchi's estimate checks closely with £1,200,000 estimated by the Anna Liffey Co., but there is a scheme on foot of a different character which is estimated to cost only £600,000.

The Irish Power Syndicate, Ltd., proposes a most interesting combination of water and peat power. It intends to avoid the high costs and the risks inherent in the construction of a great artificial lake, by developing up to 15,000 kW from water when it is available from the natural flow of the Liffey, plus only 24 hours' pondage on two sites, and to supply the balance of the demand from a by-product recovery gas-electric station on the Bog of Allan, at a point some 23 miles from Dublin. It is a new proposal for Ireland, but it is by no means unique in the world, and to anyone who is enthusiastic about the reclamation of the bog areas it is exceedingly attractive.

Geologists find grounds for suggesting that the valley above Poulaphouca was a lake in post-glacial times, and it is contended that what was once a lake can be made a lake again without overmuch risk of percolation. Others point to certain springs on the outside of the proposed reservoir which seem to derive from the inside, and they hesitate to stake everything on a storage scheme which will increase the leakage head so considerably. No-one is able to produce sections made from exploration of the strata by boring, and the Irish Power Syndicate seems to think that the rational method of procedure is to begin with a 12-ft. dam on a broad base, which can be raised by stages as the demand warrants, so avoiding the fiasco that has occurred more than once when important reservoirs were completed and were found then to be incapable of holding water.

If there is a risk, and if there is an alternative scheme which will deliver the goods without incurring the risk, and will do it at less cost, there seems to be only one choice in the matter, particularly if the risk can be tested at leisure hereafter without fear of loss.

The thing is not so simple as it looks, mainly because of practical complications about the intake as the dam is raised by degrees, but the scheme is well worth weighing against the others. It may be quite impracticable when submitted to close examination with all the data displayed.

The suggested pondage under this scheme would flood about 0.6 sq. mile, and that fact alone may be worth a quarter of a million pounds in compensation, land purchase, bridge building, and road alterations. That saving would pay for a larger peat station than the promoters appear to contemplate.

(To be concluded.)

Unemployment.—Owing to the railway strike, the unemployment figures for January 28th showed the considerable increase of 69,000, the total number of wholly-unemployed persons being 1,284,700 on that date. It is of interest to note that the total included about 280,000 women and girls. The number of "short-time" workers rose from 51,300 to 52,500.

E

A Safety Brake for Boosters.

By DAVID ROBERTSON, D.Sc.

Source of Danger.

A BOOSTER is a machine which adds an extra e.m.f. to one already existing. In many cases it carries a current which is not greatly altered by considerable changes in the e.m.f. of the machine itself, and consequently this current does not die away rapidly as the machine accelerates, as would be the case with an ordinary motor.

The current produces in the booster armature a torque which opposes the motion when the booster helps the current, and helps the motion when the booster opposes the current. The booster thus acts in these two cases as a generator and motor respectively.

The booster must, therefore, be connected to a second machine which gives to the booster, or absorbs from it, the necessary power. This second machine is commonly referred to as the "motor," although it may have to function either as a motor or generator according to the circumstances.

Under normal conditions, the motor takes current from the mains, or returns current to them, sufficient to balance the booster torque. With a given load the speed thus remains fixed, but it may vary somewhat with a change of load.

But if for any reason the motor comes off the mains while the booster is carrying load, there will be nothing to oppose the booster torque except the losses in the machines. If the booster were motoring at the time the speed would immediately begin to rise, and, provided mechanical breakdown did not first occur, the acceleration would continue until a fresh balance was obtained by the combined effects of increase of loss torque and decrease of booster current due to the growth of its opposing e.m.f.

Thus the speed would rise until the booster e.m.f. approximated to that of the supply in series with it.

The smaller the booster excitation, the higher the speed required to get a balance, but on the other hand, the smaller would be the booster torque with a given armature current, and consequently the greater would be the restraining effect of the losses and the slower the acceleration.

Thus, if the booster were excited to give at normal speed 10 per cent. of the supply voltage, it would try to run up to nearly ten times normal speed, which would be certain to wreck it. But if excited to half the supply voltage, it would not run above twice normal speed, but would reach that speed much more quickly with the same armature current, because of the larger torque.

If the booster happened to be generating when the motor was disconnected, the only difference would be that it would first stop and then accelerate in the reverse direction.

In the case of a booster charging a battery, the dangerous condition might arise very simply in a number of ways. For instance, the attendant might open the motor switch before the booster switch, or a heavy overload on the busbars might easily blow the fuse, or trip the circuit breaker, of the motor and leave the booster in circuit with the battery and the load.

Requirements of a Safety Device.

As the armature current may be but a fraction of full load current, no protection can be obtained by fuses or by a circuit breaker alone. Some device operated by excess speed is necessary.

Where it is permissible to disconnect the booster altogether, this device might be arranged to open the booster circuit breaker, either by opening a holding circuit or by closing a tripping circuit.

In a small plant the power continuously consumed by a holding circuit is a rather serious item, whereas a separate tripping circuit is not altogether reliable.

If, as in the case mentioned below, it is not permissible to open the circuit, the booster field may be killed, or its armature short-circuited, or both. But it is not safe to kill the field alone unless some mechanical brake is provided to deal with the small residual torque which may exist due to residual magnetism or to the magnetising effects of armature reaction and the commutating poles.

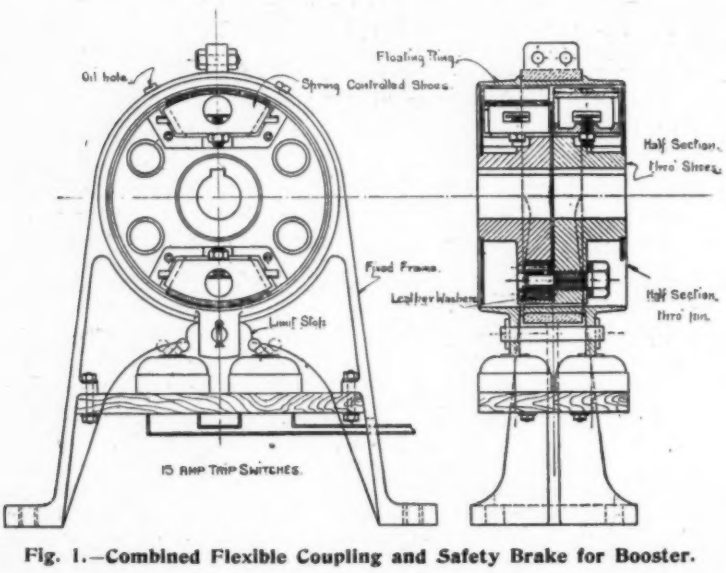


Fig. 1.—Combined Flexible Coupling and Safety Brake for Booster.

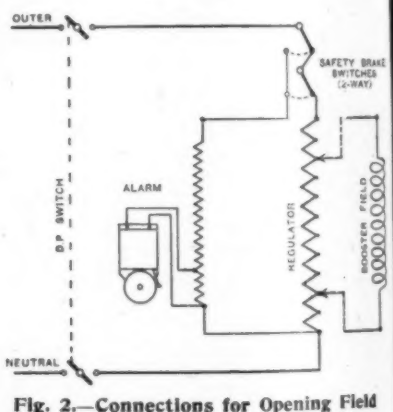


Fig. 2.—Connections for Opening Field Circuit and Closing Alarm Circuit.

Conditions to be Met by the Plant Described.

In the station at the St. Monica Home of Rest, Bristol, in which the device described below has been installed, there is a three-wire system at 2 x 105 volts, with a large battery which usually acts as balancer. The booster-balancer set consists of four coupled machines, of which each booster is rated at 5 kW, made up in any way with a current not exceeding 200 amperes, and pressure not exceeding 40 volts.

It is not permissible to open the booster circuit, for, unless the generating plant were running, that would throw the whole institution into darkness, and might leave one of the lifts between two floors. If one or more

generators were running, power would not be cut off, but the three-wire system would be left without a balancer.

It was, therefore, decided to kill the booster field and to provide a mechanical brake to deal with the residual torque. No suitable apparatus could be found on the market, and so a special design had to be made. This was done in conjunction with Messrs. Thomas Broadbent & Sons, Ltd., making use of their well-known centrifugal clutch.

As the device may be useful to others, a description of the arrangement, as made by them and fitted to the booster set by the Electric Construction Co., Ltd., is given below. By making it also act as one of the flexible couplings, the overall length of the set is no more than would be necessary if it were omitted, whilst its cost, including the switches, was less than 10 per cent. of that of the set.

Description of Safety Brake.

As may be seen from fig. 1, the two bosses, which in the ordinary way would form the half couplings, carry the flat springs which support te brake blocks and hold them in against centrifugal force. Supported from the bedplate by a suitable pedestal, a common floating ring surrounds the brake blocks on both bosses, and is engaged by them when the speed exceeds a certain limit.

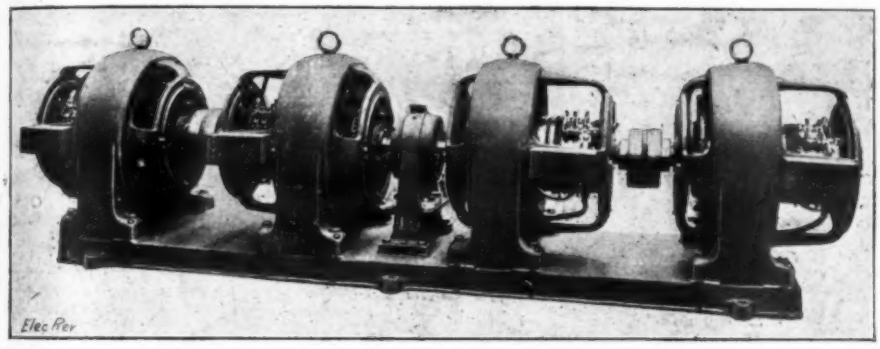


Fig. 3.—Booster-Balancer Set with Safety Brake.

The floating ring can move through a small angle, limited by stops, and in doing so it operates the switches on one side or the other by means of the levers which form part of it. A pair of switches, in series, is provided for each circuit so as to deal with both forward and reverse racing of the set.

In this case, only a small current has to be broken, and 15-ampere Crabtree tumbler switches are ample for the purpose, but there would be no difficulty in arranging for the direct mechanical operation of large switches, for the power available for the purpose is that driving the booster, and not merely that controlled by a small relay.

In this particular brake the calculated force available at the end of the lever, with both halves of the coupling in operation, has the following values:—

Speed, r.p.m.	1,200	1,300	1,400	1,500	1,600
Force, lb. wt.	0	10	30	50	75

The normal speed of the set is 1,000 r.p.m., and the engaging speed of the clutch 1,200 r.p.m.

The connections are given in fig. 2. The switches used are two-way switches, so that an alarm circuit is closed at the same time as the field circuit is opened.

When the set begins to race, the switches will be opened as soon as the speed is high enough to give the clutch sufficient torque. If there is a residual torque exceeding the losses, the set will continue to run at that speed which enables the brake to absorb such excess torque, and the corresponding power is dissipated as heat in the brake.

Fig. 1 also makes it clear how the arrangement acts as a flexible coupling of the pin type engaging in leather-bushed holes. The four coupling pins can be removed if it is desired to run one half of the set by itself for any purpose.

Tests made on Safety Brake.

The brake was fully tested under working conditions at the E.C.C. works after it had been mounted in place on the set.

When running at the normal speed of 1,000 r.p.m. with normal volts on the motors, the boosters were excited to 25 volts each, and connected across 210-volt mains in series with one another, and with a resistance which limited the current to 400 amperes, that being twice full load current for the boosters.

When the motor supply was cut off, the speed rose rapidly to 1,500 r.p.m., at which the safety device operated. The speed then fell slowly to zero.

With the booster field reversed, the set stopped and speeded up in the opposite direction until the safety device operated at 1,450 r.p.m. This time the set continued running at 1,350 r.p.m. After five minutes running under this condition, the brake was still comfortably cool.

The difference between the final results with opposite directions of rotation is due to some small want of symmetry, causing the residual torque to be greater in one case than the other. It might be caused by a small amount of backlash in the brushes or brush gear, by having a different distribution of current over the faces of the brushes, or a different distribution of the forward and reverse residual fluxes.

Some particular position of the brush-holder would give no residual torque, but any of the above mentioned causes would make this position different for the two directions of rotation.

It was actually found that the brushes could be adjusted so as to make the set come to rest after forward, or after reverse racing, but in either case the set always continued to run after racing in the other direction.

The residual torque necessary to get continuous rotation is very small, for the set is mounted in ball bearings and has very little friction.

The Batti-Wallahs' Society.—At the Hotel Cecil, on February 6th, the Batti-Wallahs, who have had a very successful season, entertained Dr. S. Z. de Ferranti at luncheon. Mr. Barralet presided over a gathering of some seventy members and guests, and, after a humorous foreword, called upon the guest of the day, who held his audience spellbound whilst he described some of his early "failures." Dr. Ferranti pointed out the enormous difficulty of seeing into the future, and showed how near he came to inventing the induction motor and the tungsten lamp in 1881, but failed "for want of prevision"—the last thing that anyone would accuse him of nowadays. The mercury meter owed its origin to experiments with a small quantity of steel melted in a Siemens electric furnace in the presence of a magnetic field. Proposing his health, Mr. R. W. Hughman said that his influence had permeated almost every field of electrical activity.

Faraday and Maxwell Scholarships.—The annual examinations for a Faraday Scholarship of fifty guineas per annum tenable for two years in college and one year in manufacturing works, and for a Maxwell Scholarship of fifty guineas per annum tenable for one year in college and one year in works, will be held at Faraday House on April 8th, 9th, and 10th. Exhibitions may also be awarded to candidates who acquit themselves creditably in the above examinations, but who do not obtain the necessary number of marks to qualify for the Faraday or Maxwell Scholarships. The subjects of examination for the Faraday Scholarship are geometry, algebra, trigonometry, dynamics, statics and hydrostatics, geometrical and freehand drawing, chemistry, and physics. For the Maxwell Scholarship the subjects are mathematics, dynamics, statics and hydrostatics. Further particulars may be obtained from the secretary, Faraday House, 62-70, Southampton Row, London, W.C.1.

Electric Level-Luffing Cranes.

The Ardrossan Harbour Installation.

By W. A. PERRY.

THE Clyde Crane & Engineering Co., Ltd., Mossend, near Glasgow, has recently built and supplied electric level-luffing dockside cranes to the Ardrossan Harbour Co., Firth of Clyde, Scotland, which were made to a specification supplied by the Harbour Co. to fulfil special requirements at the port, and embody several novel features.

The cranes, one of which is shown in the accompanying illustrations, are capable of dealing with loads up to seven tons, at a maximum radius of 45 ft.; they have four separate motions, *viz.*, hoisting, luffing, slewing, and travelling. Each motion is operated by a separate

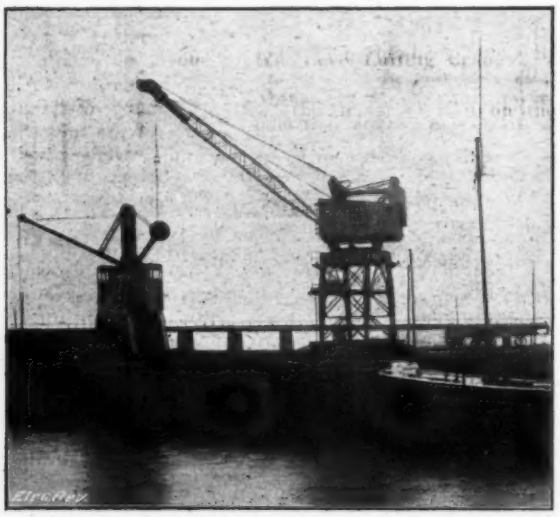


Fig. 1.—A 7-ton Electric Level-Luffing Crane

motor and controlled from the driver's cabin on the revolving superstructure. The speeds of the various motions are as follows:—Hoisting, 200 ft. per minute; luffing, 120 ft. per minute (average); slewing, 300 ft. per minute (at maximum radius); travelling, 50 ft. per minute. The range of lift is from 40 ft. below to 55 ft. above the quay level, and the gauge of the travelling tracks is 14 ft.

While the cranes are being used for dealing with all kinds of general cargo, they are also provided with gear for operating a Priestman grab for the unloading of iron ore or similar material from ships to railway-trucks. The grab-operating "bell" is arranged to give a varying height of discharge and can be raised to the jib head when the crane is working with an ordinary cargo hook.

The "Jardine" improved patent luffing motion is employed, which maintains a perfectly level load line between maximum and minimum radii, and as the jib is perfectly balanced in all positions by a movable balance weight irrespective of the load on the hook, the only function of the luffing motor and its gear is to alter the radius of the jib; in other words, the only power required is that to overcome the friction of the jib in its various parts. This allows of a *small* motor being supplied for this motion, namely, one of 10 h.p., whereas if (when luffing) the load were raised it would require a much larger motor. On testing these cranes it was found when lifting from three to four tons of ore with a Priestman grab, which gives a total weight of about seven tons, that the energy used was from 0.2 to 0.25 kWh per ton of material discharged. This figure, of course, includes the power used in lifting the grab and moving it back and forth between the ship and railway truck. When the crane is used for general cargo requiring no grab, the consumption per ton will be very much less. The speeds of the various motions are at their most economical value for this size of crane, and it has been found that approximately the same quantity of material can be discharged with this crane per unit of time as that discharged by the other steam or hydraulic non-luffing cranes of double the capacity and at, of course, a much reduced working cost.

The speed of the load when luffing varies from maximum to minimum radius, the maximum speed being attained at the middle of the stroke with a gradual slowing down to a dead stop at either extremity. This is the ideal jib motion for a luffing crane as it reduces the swinging of the load to a minimum.

The hoist rope is independent of the luffing gear, and may pass direct from the hoisting barrel to the jib head sheave as in an ordinary jib crane, thus giving long life to the hoist rope. All the gear throughout the crane is thoroughly protected and efficiently lubricated, and the first motion gears in the superstructure are run in cast-iron cases forming oil baths which give high efficiency to each of the motions.

The superstructure is carried on eight conical steel rollers running on a machined path tapered to suit their inclination. The path girder is provided with renewable pin teeth forming the slewing rack into which

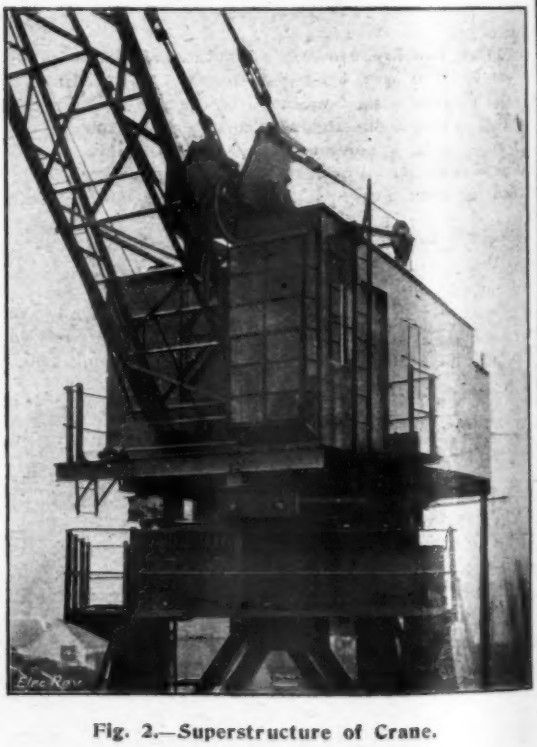


Fig. 2.—Superstructure of Crane.

gears a steel pinion actuated through a worm reducing gear which is provided with a special adjustable slipping device.

The whole front of the operator's cabin is formed by a steel-framed bay window, which gives the driver an unobstructed view in all directions.

The crane is carried on eight double-flanged steel

travelling wheels, two at the foot of each leg, these being arranged in compensating bogies so that the load is evenly distributed. The electrical equipment is designed for a 3-phase, 420-volt, 50-period circuit. The motors and control equipment are of the Metropolitan-Vickers Electrical Co.'s manufacture.

The motors are one-hour rated; the hoisting motor control is of the contactor type, the other motions having ordinary drum reversing control. The hoisting and luffing control handles are arranged to move in the direction of the load. The usual limit switches are fixed to limit the travel of the hoisting and luffing gears, though these are not really necessary on the luffing motion, as the jib is luffed by crank and connecting rod. The maximum and minimum radii being defined by the throw of the crank, it is therefore impossible to over-run the jib; it will come to a dead stop at one extreme radius and then return in the reverse direction, repeating this cycle of operations while the controller is "on." Limit switches have been fixed, however, so as not to reverse the direction of motion with regard to the controller, which would happen if the crank passed the dead centre.

The power is taken from the company's sub-station by underground cable to plug boxes along the quay, the cranes being connected to the boxes by means of flexible cab-tire sheathed trailing cable; the length of the cable is such that it allows the crane to travel 60 ft. each side of either of the plug boxes.

Ample lighting is provided throughout the crane and a powerful light is fitted on the under side of the jib.

Staff Efficiency in Electricity Works.

[COMMUNICATED.]

To get one hundred per cent. efficiency out of the staff should be the desideratum of every undertaking. Probably it is. But where one undertaking differs from another is in the method employed. There are two opposing ways: one is by cussing, the other by kindness. The first method is the "hustling" one—you rely upon chivvying everyone every moment of the day. You keep an unwinking eye on every member of the staff; you see whether anything can be done in two and a half minutes instead of three, and so on. One hears high praise of this method from America. The other method is encouragement—binding up the interests of the staff with the interests of the undertaking—making the welfare of the one the welfare of the other. This second method implies some faith in the old aphorism *Amor vincit omnia*, or at any rate in its diluted business form: "Look after your staff and your staff will look after your business!" We are reminded of all this by the speech of the chairman of Lloyds Bank, at the general meeting on February 6th. This bank has established a "staff profit-sharing scheme"—by which after the dividend paid to shareholders comes to a certain rate a proportion is set aside for distribution among the staff.

The chairman said: "I do wish to emphasise as forcibly as I can the value of the principle which identifies the interests of the employed with those of the employer. Great mischief is being done every year up and down the country by preaching the contrary doctrine." He went on to say to the shareholders: "to make all the members of the staff partners, even to a small extent, with yourselves in the business of the bank, cannot but stimulate them into greater keenness." And if "keenness" is an asset in a conservative, cut-and-dried business like the routine of banking, what is it in a progressive, developing business such as electricity supply, where every succeeding year brings new methods, new problems, and so forth? Moreover, there are few businesses which can compare with that of electricity supply in the way in which even for junior members of the staff, there is a big margin by which they can personally retard or contribute to the success of the undertaking. We are not referring here to the question of "slacking" or evading their duties—that, of course, applies to every business alike. What we do mean is the exercise (and development) of personal initiative.

The perfunctory, even if faithful, fulfilment of duty is, in the electricity supply industry, far short of one hundred per cent. efficiency. What is wanted is that everyone should use his brains to the utmost, and make full use of the immense scope offered by the class of business, in almost every grade of its officers. But no employer can expect this unless he shows himself appreciative, and expresses such appreciation in the business-like way of proportional remuneration. Whether that should be by a profit-sharing scheme, bonuses, or any other way is for undertakings to decide. All we are concerned with is indicating that it is the added bit of incentive that will produce the added bit of efficiency that makes "all the difference."

The French Physical Society's Exhibition.

(*Continued from page 209.*)

The Epidactyloscope.

THE examination of fingerprints is usually done with a magnifying glass, a slow and inefficient method which is inadequate to modern needs. M. Beyle, director of the French identification service, has devised an apparatus which enables all the operations to be carried out very quickly and without personal fatigue. It consists of a special projector which brilliantly illuminates a window in front of which can be placed a carrier holding the cards to be examined. An enlarged image of the

Fig. 6.—The Epidactyloscope.

impression is thrown by a lens and mirror on a table in front of the apparatus. The source of light is an incandescent electric lamp, and the illumination of the image is sufficient to enable it to be examined in daylight; provision is made for adjusting the height of the table and for affixing to it the paper on which notes and sketches of the characteristics of the print are made. The prints in the slide can be quickly changed and examined in succession as if one were reading a book.

The Baule Servo-Motor.

To perform mechanical movements at a distance an electromagnet must have a long solenoid, with consequently a large time-constant which involves delay in operation; if a short winding is used with a heavy current the difficulties of heating and sparking at the contacts arise. In order to obtain the advantages of a small winding, large power, and long pull without heating and sparking, Naval Lieut. Baule has adopted the use of a high voltage, together with a device which inserts a large resistance in circuit with the magnet when the armature has reached the end of its travel, thus preventing overheating and minimising the spark when the circuit is interrupted.

The inventor has devised an electromagnet exerting a pull of from 8 to 12 kg. over a distance of 25 mm., which completes its travel in a hundredth of a second from the moment when the circuit is closed. On this basis he has constructed a servo-motor shown in fig. 7, which is capable of performing a variety of operations at a distance from the operator. The motor consists of three electromagnets acting on a central crank, and can run at any desired speed up to 1,500 r.p.m., which corresponds with 150 different positions of the magnets

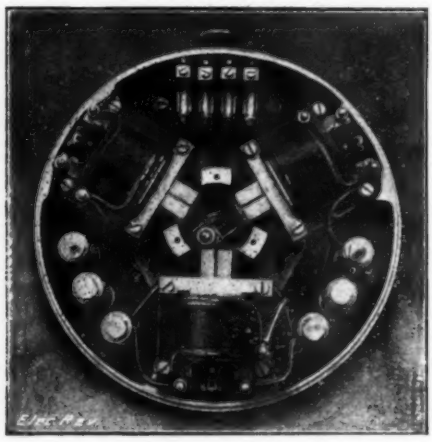


Fig. 7.—The Baule Servo-motor.

per second. The motor has practically no rotational inertia, and can be stopped at pleasure at any one of these 150 points; thus it lends itself to a wide range of requirements. In the Homburger device for aiming at a distance it has enabled a gun to be set to one minute of arc with a speed of movement reaching 2 degrees a second, which means that in one second the gun passes through 120 different positions, at any one of which it could be set. The motor can obviously be applied to numerous industrial purposes.

The Pinot Morse Printer.

Hitherto the only high-efficiency Morse printer capable of being used in cable and wireless telegraphy has been the Creed apparatus, in which the signals received are caused to perforate a paper tape which is afterwards put through a translator to obtain the printed slip. The apparatus devised by M. Pinot translates the Morse signals directly into typographical characters. If one transmits by hand with an ordinary Morse key, the record is made as regularly as with a perforated tape.

The apparatus consists of three essential parts: the regulator, selector-distributor, and translator (fig. 8). The regulator, automatically controlled by the speed of sending at the station of origin, is actuated by the signals received by wire or wireless receiving apparatus. The selector-distributor, driven by the regulator, sorts out the dots and dashes of each signal received, and the translator, electrically driven by the distributor, prints the corresponding letters on a tape. The printing characters are fixed on the periphery of a disk as in the type wheel of the Hughes and Baudot apparatus.

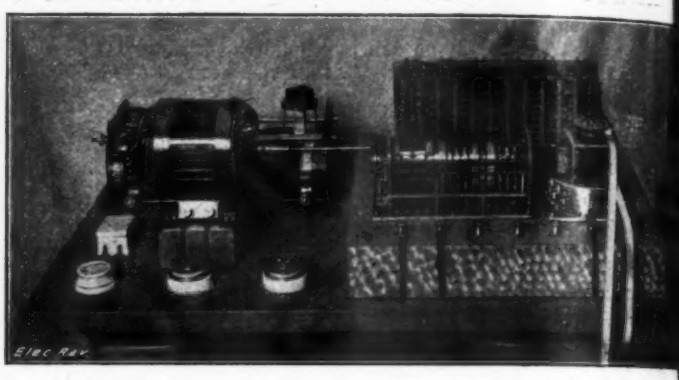


Fig. 8.—Pinot Morse Printer.

The model here illustrated is said to work perfectly, but the inventor is engaged in making certain detail improvements which practice has shown to be necessary.

The Dufour Cathodic Oscillograph.

This apparatus has been devised for the examination on a screen, or registration on a photographic plate, of variable electromagnetic phenomena of whatever form and frequency. The range of frequencies extends from nought to hundreds of millions per second. It is based upon the Braun tube, using a pencil of cathode rays as the indicator, which is deflected by the magnetic or electric field. The apparatus consists of a metallic bell on which is mounted a glass cathode-ray tube; inside the bell is placed a film on a revolving drum or a magazine of negatives to receive the records, and under it are the air pumps to produce the necessary degree of vacuum, namely, a mechanical pump working in oil and a molecular pump giving a vacuum of the order of 0.01 mm. of mercury.

In the upper part of the bell are two glass tubes, one of which is the deflection tube whilst the other contains the electrodes—a small disk for the cathode in the upper part of the tube and a metallic tube pierced with two small holes for the anode, producing a very minute pencil of cathode rays. This tube is excited with a pressure between 30,000 and 60,000 V.

For recording frequencies up to some hundreds of thousands per second a film is used, rolled on a drum; the latter is mounted inside the bell on a spindle carried by ball bearings and is driven from outside by a rotating magnetic field. An automatic switch enables a record to be made at the desired moment during a single revolution of the drum.

For higher frequencies a fixed photographic plate is used by an ingenious device. To record at a frequency of 5,000,000 cycles a second, for example, the cathode pencil is made to oscillate by means of a magnetic field produced by a heterodyne at a frequency of, say, 40,000 cycles a second, tracing on the plate a corresponding sinusoidal curve. The current to be studied is then brought into operation through coils perpendicular to the former, making a record therefore at right angles to the basis curve at 40,000 cycles. It is stated that with this oscillograph records of phenomena at a frequency of 220,000,000 per second have been obtained.

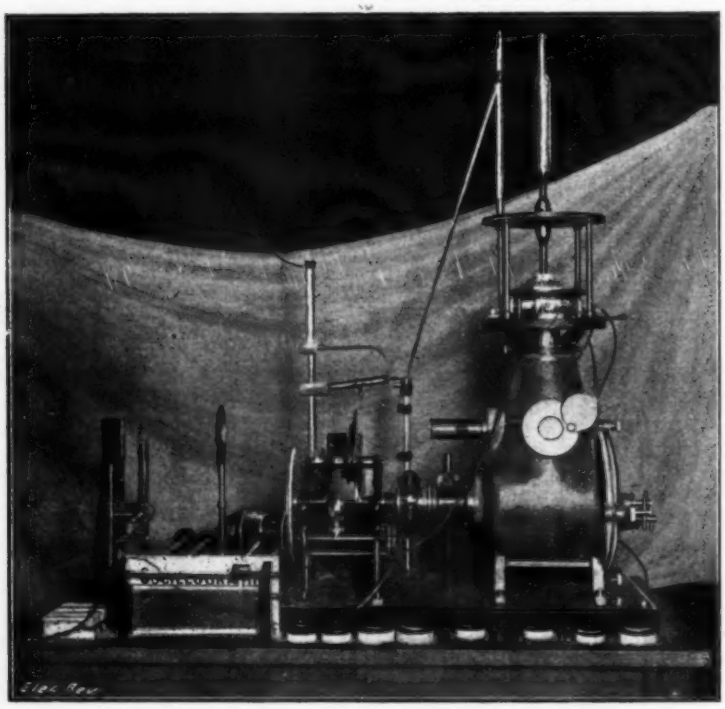


Fig. 9.—The Dufour Cathode-Ray Oscillograph.

(To be concluded.)

Some Implements used for Manipulating Electric Furnaces.

By "LAPIS LAZULI."

WHEN electric furnaces were first introduced on a large scale, the tools and implements used for manipulating operations were mostly similar to those employed for coal, coke, or gas-fired furnaces.

As time has passed and further experience has been acquired, the more extensive application of the electric furnace has made it necessary to provide rabbles, shovels, pinches, &c., of suitable shape and size to meet their requirements. Generally speaking, the electric furnace does not need the assistance of so many varied implements as the older types of furnaces required. This is partly due to the fact that most modern furnaces can be tilted by power when any alterations, repairs, or improvements have to be made, and in this way many tedious and prolonged operations at the hot ports are obviated. The convenient shape in which these modern hearths are constructed enables an unwieldy charge to be handled in a way which previously would have been considered little short of miraculous.

For example, a common practice in many foundries is to increase the weight of the charge when word has unexpectedly been given that more than the normal weight of metal is required.

This is usually a matter for serious consideration where stationary furnaces are employed, but with the electric hearth it is a comparatively simple matter, since by tilting the latter backwards from the ports a larger area is provided for holding the metal. The numerous other advantages gained by the assistance of electric power for tilting the plant need not be entered into in detail here.

Gloves.—It might be expected that rubber gloves would be used to protect the hands from electric shock, but this is seldom the case in ordinary works practice, as the voltage is not as a rule so very high.

Rough thin split leather gloves are preferred, which although not so capable of protecting the hands from shock, are more durable and less expensive, besides providing better protection of the skin from burns.

Regarding the size, the best make of glove should reach within a few inches of the elbow, and be well padded at the palm and finger tips. The long gloves afford greater protection to the face of the melter when he is mixing and rabbling the metal, or removing the molten slag. A still commoner type of glove largely employed by the furnace labourer is simply a bag made out of packing sheets sewn together with carpet thread.

These are not very durable, but when they wear out can be replaced with fresh ones without running into much expense.

Shovels.—Ordinary shovels are not satisfactory when charging varying loads of fluxes, ore, or special alloys, and weighing each individual addition becomes a tedious and laborious matter, when a large number of charges have to be worked at a time. A much better procedure is to weigh out a box-full of the ingredient, and place it on the charging stage, after which shovels of fixed capacity are employed to make additions of known quantity. The blade of a shovel can easily be cut down, so that when filled with any powdered material it represents a desired weight.

These shovels are of particular value in controlling the carbon content of steel in electric furnaces.

Manipulating the carbon content of steel which is melted under arcs is one of the most trying problems encountered in practical electrometallurgy, and anything which can assist the melter to make an accurate measurement of material (without wasting time in weighing) is of considerable value.

The Slagging Bar.—The "horse," or slagging bar, provided for the older types of furnaces consisted of a wrought-iron bar or rod fitted to the door frames, or fixed to an iron base which held it in position. The "horse" is used to act as a fulcrum for rabbles, pinches, skimmers, &c., to rest on when any prolonged operation requires to be conducted on the metal lying in the bath.

In the more modern types of electric furnace, a small slotted iron plate is fitted to either side of the charging door, so that the bar may be fixed on at a moment's notice.

If these slotted plates were directly connected to that part of the shell which touches the magnesite lining, they would allow the current to pass directly to the hands of the operator. As a measure of protection, the plates should be provided with some insulating material, so that if any accident with the transformer did occur, the effect of the current would not be felt to the same extent.

The slagging bar consists of a turned wrought-iron rod, with a kink at the middle, on which tools for treating the molten mass may rest.

As the rod lies loosely in the socket, in this instance, it allows free movement of the implements used to work the charge, whereas with the older types of furnace, the fixed bar limited the extent of the application.

Pinches, Rabbles, Cleeks.—Pinches, rabbles, and cleeks are used for several purposes in electric furnaces, and are not confined to any one operation, as in refining metals in reverberatory or regenerative hearths.

As most electric furnaces possess fixed roofs, the charging of scrap metal is a much more prolonged job than with the older hearths, the latter being provided with movable roofs. The movable roof allowed the charging to be carried out by means of an overhead travelling crane, also the size of metal dealt with could be of almost unlimited proportions.

Due to the construction of the average electric furnace, and the arc type in particular, the charging must be conducted through side doors. As charging machines have not been adopted yet to any extent with these modern hearths, the charging is done by hand.

The scrap metal to be remelted is piled up on the stage, whence it is thrown into the bath of the furnace by several labourers.

Since this means that the mass of metal inside lies in an uneven heap, it is necessary to adjust it so as to occupy as little space as possible. This is accomplished with the aid of pinches which are employed to drive the pieces close up against each other. In some small furnaces, the capacity is not sufficiently great to hold a desired weight of metal, and this can be made up for by melting a certain amount and thrusting down the remainder with pinches and rabbles as soon as it becomes soft, thus providing more space for fresh metal to be charged.

Besides skimming off slags, rabbles are useful in determining the temperature of metal which melts at high temperatures as pyrometric results are unreliable. The slag on top of the metal renders the optical pyrometer readings inaccurate, and the resistance pyrometer cannot be easily manipulated at the hot doors, so that to the experienced melter the insertion of a rabble is the best indication he can gather.

On removing the rabble from moderately hot liquid steel it will be bent or misshapen, but from overheated metal is will show a portion cut clean off.

The "peel" is not so much in evidence in this modern work, as many operations can be simply conducted with common cleeks.

Changing the Periodicity.

By A. C. BOSTEL.

WHEN it was decided to change the periodicity of our supply from 60 to 50 it was thought that considerable difficulty would be experienced with the consumers, but the subject offers very little trouble if tackled in a proper systematic manner.

In order to save trouble, the preparation for such a change-over must be commenced a considerable time beforehand, because the one thing which is vital to the success of the scheme is the satisfaction of the consumers. Too much time and trouble, therefore, cannot be spent in studying and recording the personality of each. Some, and usually the better educated, may be spoken to in an honest way by pointing out the necessity of such a change, and promising the utmost support of the undertaking in righting any inconvenience that may occur. On the other hand, a few would be eager to seize the opportunity of trying to get something, on the score of an imaginary grievance. With this type of consumer, a gradual leading-up to what is to happen is necessary.

Lighting.—The only trouble which one might anticipate would be with arc lamps and small transformers. For some time previous to the change-over, we had advised most of our consumers who, we knew, had transformers, to do away with these, as though metallic filament lamps were just as strong at the higher voltages, a constant waste was always going on in the transformers in no-load losses. In order to convince a sceptic of this a small wattmeter was put in circuit, and so, except in a few cases, most of these small house transformers were removed. Those that remained have given no trouble—at least we have not heard of any. One would expect to hear of overheating due to increased iron losses and magnetising current, but probably a number of them were really made for 50 periods and had been operating on 60.

The same remark applies to arc lamps. We had got practically everybody who used them to adopt gasfilled lamps or a scientific method of interior window lighting; we were aided in this effort by the lighting restrictions which were improved and the difficulty in obtaining carbons. With those few that remained, considerable adjustment had to be made to enable them to burn steadily.

Power.—This was, of course, our main source of expected trouble. Owing to the magnetising density of the iron being increased, one would assume that the motors would run very much hotter; also a lower power factor would result. The latter does not affect the consumer, nor does the former to any great extent, unless the motor is running up to its full rated output—then it is liable to become heated beyond the usual temperature rise allowed.

The next, and by far the most expensive trouble to deal with, was the reduction of speed in direct proportion to the change of periodicity.

In view of this we had kept for years a very accurate record of every motor that had been connected to the circuit. A man was sent round to every motor to get the necessary details, and enter them on a card with any remarks that might be made dealing with the proposed change. When this was done, details were entered on the right of the card showing what was necessary to give the same belt speed, and whether to change the motor pulley or main shaft pulley.

These cards were then sorted out into those that mattered and those that did not. It is interesting to note how few people have any idea of the speed of their main shaft. Consequently, the question was asked: "Did it matter if the line shaft ran a little slower?" Those cases that it was necessary to deal with as soon as the change was made were classified according to make of motor, and each motor manufacturer was written to, giving the type, number, and output of this particular type, with a request to quote for a pulley of the required size of bore and keyway.

When these came to hand they were at once delivered on to the respective jobs and "offered" to the motor shafts, and although some of the motors were 15 years old, except for a little easing or a small liner here and there, no trouble was experienced in fixing, which speaks very highly of the methods adopted by the manufacturers for keeping records.

In the case of those motors which were difficult to treat as mentioned, main shaft pulleys of smaller diameter were supplied. It was found that considerable interchangeability saved the cost of many pulleys.

No trouble was experienced with fan motors, although of course a reduction in speed was inevitable, but even if new ones were supplied no greater speed than a synchronous one of 1,500 r.p.m. could be obtained unless one went to 3,000. There were quite a number of small motors of ½ b.h.p. and under, but as the majority of these were found to be running considerably under load, no overheating occurred. Those that were loaded up had to be rewound.

Small dental motors being mostly of the repulsion type, slightly higher speeds were obtained when the change was made, and it was found that for the more delicate operations the lowest speed was too fast. A complete dental set was purchased suitable for the lower frequency, and each dentist was advised that it would probably be necessary to take his engine away to be adjusted; in the meantime one was lent. The field coils were previously made by the manufacturers, and the whole matter was placed in their hands, which proved to be very satisfactory. In the case of lifts and automatically-operated gear, each manufacturer was advised as to what was being done, and instructed to carry out the necessary alterations.

Church organ-blowing apparatus was mostly direct driven, and had to be very carefully reviewed. It was found that in one or two cases the fans could be interchanged, but in the case of those that were direct-driven it was necessary to supply new fans.

It was at first thought that the drop in pressure and volume of air could be counteracted by increasing the diameter of the impellers where they had only a single stage, but the clearance between the impeller and the case being small, it was decided to supply new multistage blowers. In the case of the multistage blowers already fixed, another stage was added.

Motor-Generator Sets.—It was thought that by a rearrangement of the field coils of the d.c. side, the increased output due to the reduction of speed would give the desired result, but although in some cases we were able to do this, the result did not appear satisfactory; so each set was taken in turn and rewound, two complete sets being previously purchased to replace those taken away.

It is difficult in a small space to detail the many little troubles that have occurred since the change, but the whole secret of success lies in picking out the right man, who must have a wide knowledge of shop driving and general engineering work, to carry out the organising of such a change. He must spend his time freely in preparation, to leave nothing unprovided for, whether it be a 1/20-b.h.p. or a 100-b.h.p. motor. It is necessary to attend to every little complaint, and see that everybody is satisfied.

The change-over was made nearly three years ago, and we have never had any serious complaint from any consumer.

How to Create a Demand for Electric Service.

By R. HARDIE, Associate I.E.E.

(*Abstract of paper read before the* ELECTRICAL SOCIETY OF GLASGOW.)

ALREADY it has been emphasised that the chief aim of men engaged in our industry must be the rapid development of electric "Service." After 40 years of presumably hard work we can only claim, at most, from 10 to 15 per cent. of the houses in the United Kingdom to be using electricity for any purpose. In Glasgow there are over 200,000 unwired houses and only 11,500 domestic electric light consumers, roughly eight per cent.; further, this percentage is only being raised by a small fraction year by year.

We are not entitled to plume ourselves on the slight progress that has been made. Many of those now using electricity do so not from any reasoned effort on our part; they have come along mainly of their own volition.

Whatever opinion we may ourselves hold, there is general agreement on the part of outsiders regarding the backward state of the electrical industry in this country, despite the acknowledged fact that our electrical engineers are to-day the equal of any in the world, and that electricity is generated as cheaply here as anywhere in the world. Mr. R. B. Mitchell in his recent I.E.E. address made the indictment sufficiently forceful, and it was most humbling to read the opinion of the editor of the American *Electrical World*, who last summer visited Europe. He was astounded at the lack of evidence of electric service, and particularly at the number of London's chief thoroughfares illuminated by gas. He mentioned the fact that the whole electricity output for the United Kingdom (with its 45,000,000 inhabitants) was less than that generated in the Metropolitan district of New York with 7,000,000 people. He attributed the lack of progress in this country to the fact that the generation and distribution of electricity were for the most part in the hands of municipalities which he indicated were incapable of showing the same enterprise and initiative in encouraging the use of electricity as private companies have done, with which expression of opinion I disagree.

Another instance of how we strike the visitor was the statement recently made by Mr. Roberts, electrical engineer, Durban, who said: "It is a disappointment to the overseas engineer to observe on his occasional visits to the Mother Country, the comparative backwardness of domestic electrical enterprise. He comes to learn and in this branch of work goes away unsatisfied."

As to electric lighting—the battle was virtually won years ago, yet we remain within our own lines, content with seizing a small outpost here and there in an occasional sortie and studiously refraining from any general attempt to occupy the enemy's territory.

Small wonder that in face of our lethargy, gas engineers are taking heart. Retention of the gas lighting load is now underlined as demanding their serious attention, although they recognise that their only hope of retaining this lighting business is by periodical inspection and overhaul of gas fittings in consumers' premises. Gas burners are in many cases provided and fixed gratis—"free maintenance" they term it.

That is, in brief, a statement of the problem. What of the remedy? The British Electrical Development Association has grown rapidly. Still, when all is said and done, the bulk of the work must be done locally. If the domestic load is to make headway, facilities should be available for the public to see and have demonstrated the appliances actually available, as the value of electricity supply to the consumer can only be judged by the service given. We hear a good deal about restricting the selling of electrical appliances to *bona-fide* electrical firms, but departmental stores, which, in America and London, are the largest individual retailers of electrical apparatus, usually wait until the demand for this has been created and then take up the sale. They are favourably placed, having already at hand advertising facilities and the public are in any case passing through their stores. Believe me, this development spells far more danger to the retail contractor than any electricity supply authority's showroom. The opinion that the sole functions of a supply authority are to generate and distribute electricity may, in the early days, have been true. But to-day the "goods" are ready for delivery, and the clamant need of the hour is an improved load factor; thus the need for a department whose constant duty it is to discover new outlets for electricity. The progressive chief of a supply authority cannot sit in his armchair awaiting the arrival of business. He must, by every modern artifice, push his wares and in the initial stages at least this involves much unremunerative introductory work. Individual firms cannot face the cost of propaganda necessary in the initial stages to develop these loads. If it is not undertaken by the supply authority the work may well be left undone.

What steps is the electrical contractor taking to increase business? I do not presume to teach him his business; we are, however, all members of the one body, and if one member suffers, we are all affected. Last year approximately 900 new domestic consumers were connected to our mains. Even making every allowance for the dull times through which we are passing, and for the tens of thousands of tenanted houses, the occupants of which are disinclined to spend money on another man's property, the fact remains that present progress is too microscopic. For instance, the Philadelphia Electric Co. had for the year 1922 a load factor of 42 per cent., and the sales of electrical apparatus reached £200,000, 90 per cent. of which was from the sale of vacuum cleaners, washers, and irons; 40 per cent. was sold in the stores, and 60 per cent. by the outside selling staff. The kWh generated reached 956,910,225, and the total capacity of the plant installed was 425,659 kW. It added 45,126 new customers in 12 months, over 31,000 of the new customers being obtained through the wiring of old houses, and wiring is done on the easy payment plan by a number of wiremen in the city who do their own financing. In Los Angeles, California, 30,000 houses were connected during 1923, and in Cincinnati a 30-days' free trial plan was as follows:—"We will wire your home, install fixtures complete, run service lines, set meter, and turn on the electric light. After using this service for 30 days, if you are not satisfied, we will remove the electrical installation, replace your gas fixtures, leave your house in first-class condition, and you will not owe us one cent—not even for the current used. If you are satisfied, you may pay us for the wiring and fixtures in 18 monthly instalments—the bills conveniently attached to your (monthly) electric light statements."

Under these conditions the company wired over 18,000 houses, and reports that on a business of nearly 1¼ million dollars in deferred payment accounts it had at the time of reporting collected nearly 1¼ million dollars, and had no bad accounts. This 30 days' free trial scheme has also been adopted by the Edison Co., of Boston, which states that of over 2,000 houses wired under the offer not one installation has been unaccepted.

Chicago adds on an average of from 50,000 to 60,000 new consumers annually, and during the year 1922 four companies in New York connected to their lines 130,000 residential customers. In the activities of these companies (even though they be American) we may find helpful suggestions, and if American wiring contractors can find ways and means to finance this method of business, cannot we also? Of course, these results are not obtained without strenuous effort in the form of advertising and extensive solicitation, which, being interpreted, means door-to-door canvassing by trained salesmen. We cannot reasonably expect to secure business unless we adopt up-to-date methods that have been proved successful in other lines. I may be wrong, but I have the impression that, while the manufacturer and the factor have as a rule an adequate selling organisation, contractors (on whom we all lean) are not usually well equipped in this respect.

The point I wish to emphasise is that we have not in the past made any serious combined attempt to secure the large business which is available. "While you may supply the actual needs of the public without advertising, the actual needs are but a fraction of the demand that can be created, and advertising is a prime mover in creating this demand." It is not enough in these days to possess the ability to do anything; you must proclaim it from the housetops. Even an old, well established industry like coal finds it necessary to advertise, and 200 of the leading central stations in U.S.A. are spending £600,000, or about one-third of one per cent., of their gross earnings; the Boston Edison Co. spends 1 per cent., and manufacturers in U.S.A. spend from 2 to 5 per cent. of their earnings, so we have a long way to go. The Gas Department's free maintenance of lighting fittings it is estimated, if adopted throughout Glasgow, will cost £61,578, equivalent to 1.64d. per 1,000 cu. ft. of gas sold, and the scheme is to retain the price of gas permanently at 1½d. per 1,000 cu. ft. higher than it need be to cover the cost of free maintenance. My point is that this involves an outlay of between 3 and 4 per cent. of the revenue, avowedly to retain the gas lighting load.

To sum up the present position: Our business will continue to grow, in spite of ourselves, but the rate of growth will depend upon the effort which we, individually and collectively, are prepared to make. The Glasgow Corporation Electricity Department is limited in its activities by reason of the fact that the gas undertaking is an older and deeply-rooted department of the same Corporation, and every effort made by us naturally raises the opposition of vested interests. We have close on 800 houses built, or about to be built, in none of which will there be a gas pipe. In future building schemes gas need not be introduced for any purpose whatever, and experience has convinced me that, at the rates ruling in Glasgow, an electric house with its many unique advantages does not cost more than one of the older type, and, backed by personal experience, we have sought to reassure the public,

rendered timid by oft-repeated statements to the contrary by an interested opposition. False claims speedily come home to roost, but I am certain that the future is ours. Slow gradual growth is inadequate; we must take steps to hasten the coming of the electrical age. Confidence is obtained from a practical and intimate knowledge of the possibilities of electrical apparatus in one's own home, and armed with this first-hand knowledge it becomes a comparatively easy matter to argue with conviction. All the propaganda in the world will not suffice, unless there be a more general readiness on the part of electrical men to steer a consistent course, and set the example by themselves adopting electric service in their own homes and offices in a very generous measure.

Dr. Parker Smith, recently appointed Professor of Electrical Engineering in the Glasgow Technical College, is at present building a new house, which will be all-electric in every respect, including the water heating.

The suggestion that the adoption of electric service by all employés of electricity supply authorities should be made a condition of employment may seem, at first glance, rather harsh, but logically there is much to be said for it, while I should say that an electrical man who has not sufficient belief in his own wares to justify the use of electricity in his home is unfit for membership of his trade association.

It may be objected that I am always harping on the domestic load, to the exclusion of other branches, but my plea must be that in this direction lies a very great (perhaps at the moment the greatest) untapped source of business, ready to yield to a little strenuous endeavour on our part.

The Gas Turbine.

By HUGH CAMPBELL.

(*Abstract of paper read before the* INSTITUTE OF MARINE ENGINEERS.)

THERE is a total absence of any real authentic data concerning the gas turbine, although the theoretical side of the subject has been discussed fully. With the present cycle of operation in vogue, further progress with the internal combustion engines is almost impossible. I am, of course, not referring to possible economies that are still obtainable even with the present cycles of operation, but if I fixed the possible improvement at from 2 to 3 per cent. higher than is obtained in the best forms to-day, I should be putting the possible improvement at its highest.

As one who has been intimately connected with internal combustion engines for the past forty years, I am not convinced that even with the best results that have been obtained the gas turbine can be made a commercial success, yet the necessity and opportunity are there. A few years ago I was determined to set aside £20,000 for research and experimenting in gas turbines. I am pleased to-day that that sum was not used for that purpose, as I am convinced that at present there are almost insuperable difficulties in obtaining sufficiently satisfactory results to warrant the expenditure of the money. The problem is one of the few instances where theory has preceded the actual successful construction of a commercial machine. In addition to the prime mover element consisting of the rotating wheel, nozzles, combustion chambers, ignition and valve gear, there must be compressors capable of feeding the combustion chambers with air and for delivering gas for mixing with the air. There must also be suitable motors for driving the blowers, and to obtain the maximum heat efficiency there must be some apparatus for utilising the heat of the exhaust gases in some of the processes connected with the gas turbine.

The difficulties that have been experienced so far as are known have been mainly metallurgical in that a metal has not yet been found which possesses high tensile strength at high temperatures. Herr Holzwarth has patented a pure mild steel, unalloyed as far as possible with a carbon content preferably below but not exceeding 0.1 per cent., for his turbine wheels. The disk, nozzles, and blades have to withstand a temperature of about 2,500 deg. F. and pressures reaching to 300 lb. per sq. in.

Some few months ago I found some reference to a gas turbine which has been invented by Herr Leich of Hamburg. I put myself in communication with the inventor, and was told that six turbines made to his invention were actually at work in Germany. I was very anxious indeed to go to Germany to see these turbines, which were, I was told, working satisfactorily, but of which the outside world knew nothing. My desire was immediately tabooed, but Herr Leich came to England, showed me his drawings, and explained everything a short time ago. Herr Leich informed me that he had a gas turbine working on blast furnace gas in Upper Silesia of 12,500 h.p., and it had worked since July-August last, night and day without a stop, and five other turbines had been built varying from 500 h.p. upwards.

I cannot refrain from stating, however, that my own opinion is that his statements cannot be supported.

The Leich turbine, such as seen from the drawings, consists of a Laval rotor and nozzles combined with a labyrinth wheel and a great number of combustion chambers. The Holzwarth turbine has a maximum number of eight combustion chambers, whereas in the Leich turbine there may be as many as sixty combustion chambers round the circumference of the rotor, according to the size of the machine.

The Leich turbine is constructed on the constant pressure system, and the combustion chambers are extremely small, on which form of construction Herr Leich places great importance.

Herr Leich informed the writer that he guaranteed a thermal efficiency of not less than 36 per cent., and of the turbines he had actually constructed, none gave less than 31 per cent. As the writer could not be permitted to either enter into correspondence with the firms in Germany who were making the Leich turbine under licence, or to view any of the turbines said to have been constructed, he declined all proposals made to him for manufacturing this machine.

Business Notes.

Bankruptcy Proceedings.—DANIEL WM. HOGAN, 5, Lennard Place, Kensington, London, S.W.—A sitting of the London Bankruptcy Court was held on February 8th for the public examination of this debtor, who failed in September, 1923, with gross liabilities £9,985 (unsecured, £9,585), and assets nil. In reply to Mr. Vyvyan, Official Receiver, the debtor stated that for many years prior to 1914 he was in employment as an hotel manager. He was then appointed manager of the Allies Electric Lamp Repairing Company, Ltd., which was formed in October, 1914, with a nominal capital of £3,000, to exploit certain patents relating to machines for cutting electric light bulbs to enable repairs to be effected. In January, 1919, he purchased £3,000 shares and a debenture bond for £6,000, covering all the assets of the company, of which he then became managing director at a salary of £750 per annum. In order to make that purchase witness borrowed £6,000 from one Herman Strauss, a present creditor for £6,450; he paid £5,000 for the interest of a retiring director, and £1,000 was placed to the capital account of the company. On January 9th, 1919, the authorised capital of the company was increased to £30,000, and on November 11th, 1919, it was formed into a public company with a nominal capital of £55,000. In his right as debenture holder witness, on December 13th, 1921, appointed Mr. A. Elliott as receiver and manager to carry on the business, and he (debtor) assisted therein until July, 1923, when the receiver died and the company became moribund. The debtor further stated that from June, 1920, he acted as director, without remuneration, of the Yorkshire and District Electric Lamp Repairing Company, formed to use certain patents and machinery in Yorkshire. A liquidator of that company was appointed in September, 1923. He (debtor) estimated that he lost £9,000 through the failure of the Allies Electric Lamp Repairing Company, which resulted from the decision of the House of Lords *re* British Thomson-Houston Company, Ltd., *v.* The Corona Lamp Company, in January, 1921. Owing to that decision the British Thomson-Houston Company, Ltd., obtained an injunction in September, 1923, against the Yorkshire District Electric Lamp Repairing Company, Ltd., restraining it from carrying on the work of repairing electric lamps. At the time the injunction was granted negotiations were pending for the sale of the Allies Electric Lamp Repairing Company, Ltd., to Jordan Dawson & Cunningham, Ltd., for £6,000; the sale fell through for the reason that the work of the Allies and the Yorkshire Companies was identical. The examination was concluded.

HAROLD WILLIAM SLATER, trading as the Engineering Supplies Company, at 24, Grey Street, Newcastle, mechanical and electrical engineer.—At Newcastle-on-Tyne Bankruptcy Court on February 7th, bankrupt came up for his examination. The liabilities were set down at £19,794, and the assets as 19s. 10d. Debtor attributed his failure to a judgment obtained against him for £17,000 damages in an undefended action for breach of contract to purchase a parcel of scrap metal lying in South Africa. Debtor said he sold the scrap to Messrs. J. W. Ellis & Co., Ltd., Ellison Place, Newcastle, but the transaction was not completed, and he agreed to cancel the contract. He received a cheque for £1,500 from Mr. Ellis, sen., in respect of the complete cancellation of the contract. He had entered into the contract for the purchase of 10,250 tons of scrap iron and steel from a Mr. Lazarus, the price was 62s. 6d. per ton f.o.b.

South African ports. When he failed to take the metal Mr. Lazarus brought an action and obtained judgment for £17,660. The hearing was adjourned.

The following are creditors therein :—

	£		£
Bainbridge & Co., Ltd. ...	14	Machinery Market	33
Fairlamb Co	35	Metal & Hardware Products, Ltd.	61
International Trade Development Co.	167	Parkinson	25
Lazarus, L. E	17,667	Slater, W	1,319
L. & N.E. Railway Co. ...	32	Smiles, Capt.	190
London & Newcastle Supply Stores	64	United Tube Corpn., Ltd. ...	27

PERCY SHERBON KENNEDY (trading as Martin & Company), 102, High Street, Stoke Newington, electrical engineer.—The public examination of this debtor was held on February 8th before Mr. Registrar Francke, at the London Bankruptcy Court, the accounts showing liabilities of £676 against assets valued at £215. In reply to Mr. Vyvyan, Official Receiver, the debtor stated that he commenced the above business in partnership with a Mr. Martin, who died in December, 1916, and he (witness) subsequently traded alone until last October, when, owing to an execution having been levied at the premises, he was advised to file his petition. His failure was due to lack of capital, bad debts, and trade depression. The examination was concluded.

G. E. HARRIS, plumber and electrical engineer, 14, North Street, Emsworth, Hants.—Receiving order made on February 1st on debtor's own petition.

R. SPRINGER, electrical engineer and contractor, 253, Plymouth Grove, Manchester.—Discharge suspended for six months. Bankrupt to be discharged as from July 14th, 1924.

ROBERT M. SMITH (carrying on business with R. E. Hughes as R. E. Hughes, and as Hughes & Alexander), 129, Brockley Rise, S.E.23, house furnisher and electrical wireless engineer.—Application for discharge to be heard on February 29th, at the Court House, Burney Street, Greenwich.

FRANCIS SMITH, trading as Frank Smith, 6, Imperial Buildings, Dale End, Birmingham, wholesale electrical accessories factor.—The public examination of this debtor was held on February 6th at the Court House, Corporation Street, Birmingham. At the date of the receiving order the Sheriff was in possession under two executions, whilst five creditors with claims amounting to £123 were suing. Debtor had not kept proper books of account. The examination was closed.

Company Liquidations.—MOORE & BARKER, LTD., dealers in electrical supplies, 13, North John Street, Liverpool.—The creditors were called together recently at the office of Mr. P. W. Stanfield, I.A., 24, Sir Thomas Street, Liverpool. Mr. Stanfield presided, and reported that the company had passed the usual resolution for voluntary liquidation, and appointed him to act as liquidator. The statement of affairs presented showed ranking liabilities of £2,072, of which £2,066 was due to unsecured creditors and £6 to a partly-secured creditor. The net assets were £1,083, or a deficiency of £989. It was reported that the secured creditor was the bank. The liquidator had had a sale of the stock, a portion of which had been realised. The company was formed in October, 1921, with a nominal capital of £1,500, of which £1,090 had been issued. Shares to the face value of £890 were issued for cash. The remaining shares were issued to the vendors. The business had been established two years before the company was formed. During the first six months there was a loss on the trading of £78, whilst in the following twelve months there was a loss of £440. No further accounts were available. The directors only became aware of the position in the early part of the present year, and voluntary liquidation was then decided upon. After discussing the position, the creditors passed a resolution confirming the voluntary liquidation of the company, with Mr. Stanfield as liquidator, while an advisory committee of three of the principal creditors was also appointed. The following are creditors :—

	£		£
Bindem Co.	187	Ward & Goldstone	28
Engineering Supplies, Ltd. ...	186	Vincent Switchgear Mfg. Co. ...	31
Downes & Davies	154	Baxendale Bros.	24
E. B. Telgar	146	Cable Accessories Co.	26
Metropolitan-Vickers Electrical Co., Ltd.	65	Vicastle Import Co.	25
Simplex Conduits, Ltd.	57	Shenton & Co., Ltd.	15
Metallic Engineering Co. ...	54	Forward Electric Co.	12
J. Woolf	51	Rice & Bush	12
Newman Electric Co.	49	Auford Manufacting Co.	15
Electrical Supplies, Ltd.	45	Johnson & Phillips, Ltd.	14
Electrical Accessories Mfg. Co. ...	41	London Electric Wire Co., Ltd.	17
New Gutta Percha Co.	40	Curzon Manufacturing Co. ...	18
Jackson, Heiketh & Rogers ...	40	Byworth & Co.	16
British Thomson-Houston Co., Ltd.	22	Reeve & Co.	19

THE EAST LONDON MICA CO., LTD., Ringwood Road, Walthamstow, E.17.—Pursuant to Section 188 of the Companies (Consolidation) Act, a meeting of the creditors was held on February 4th at 7, Hanover Square, W. Mr. W. Wesson, A., the liquidator of the company, occupied the chair. No statement of affairs was presented, and before explaining the position of the company Mr. Wesson said that the creditors must bear in mind that the figures he had prepared were of a very approximate character. The liabilities totalled approximately £2,445. The net assets were approximately £3,333, showing a surplus of assets over liabilities of about £800. The liquidator went on to say that if the assets were realised at the amounts mentioned there would be a possibility of all the creditors being paid in full, but this would depend entirely on the result of realisation. Particulars were given of the directors' fees, and the liquidator said that if all the directors stood aside there would be ample assets to pay the creditors. A creditor asked if Mr. Grout, the managing director, would be willing to stand down. Mr. Grout replied that it would not affect the creditors very much if he did, and he thought it hardly fair that he should do so. Several creditors expressed great dissatisfaction at the way the business was carried on during the latter months. They explained that they could never get in touch with the directors, and if they telephoned there was only a girl in the office who knew nothing about the business. Another creditor said he went down to the works one Saturday morning and he was promised a cheque. On that understanding he allowed the company some more goods which it required. The goods were sent, but the creditor had not received his cheque. The creditors did not pass any resolutions, and the liquidation therefore remains in the hands of the present liquidator.

HIGGIN, LTD., 265, Deansgate, Manchester, electrical factors, &c.—The creditors interested herein were called together recently, at the Chartered Accountants' Hall, Manchester, when a statement of affairs was presented which showed liabilities of £7,722, made up as follows: Trade creditors, £4,231; cash creditor, £2,755; and bank overdraft, £737. The assets consisted of: Stock £2,129, expected to produce £1,810; furniture and fittings £382, valued at £200; payments in advance and deposits, £32; book-debts £3,094, estimated to realise £1,917; and other debts £286, making total assets of £4,244, from which had to be deducted £229 for preferential claims, and £576 due on debentures. The net assets were £3,439, or a deficiency so far as the creditors were concerned of £4,283. It was stated that the cash creditor was Mr. E. Hopkins, whose claim was in respect of moneys advanced between December, 1915, and November, 1921. That gentleman had also guaranteed the bank to the extent of £500, and he was the holder of the debenture, which was issued to him for cash in 1915. On January 21st a receiver was appointed. The liquidator stated that he was afraid there was not a very bright prospect of the business being sold as a going concern. It was reported that the company had been in existence for a number of years, having been formed with a nominal capital of £1,000. It appeared that during 1917 the turnover was £5,345, with a net profit of £110! The following year the turnover fell to £3,140 and there was a net loss of rather more than £600. In 1911 the turnover went up to approximately £14,000, and there was a profit of £770. In the following twelve months the sales jumped to £28,400, but the net profit fell to less than £100. In 1921 the turnover went down to £16,000, and there was a net loss of £203, whilst in 1922 there was a net loss of £1,200 on sales of £11,300. During 1923 it was estimated that the sales were only £8,700, with a loss of £2,500. The deficiency was attributed to the loss on the trading, bad debts and the amounts written off the assets in the statement of affairs. The company held various agencies, some of which were valuable. The creditors passed a resolution confirming the voluntary liquidation of the company with Mr. E. Royce, C.A., of 22, Cooper Street, Manchester, as liquidator, while an informal committee was appointed consisting of the representatives of Electric Lamp Factors, Ltd., London; General Electric Co., Ltd., Manchester; and Poppleton, Appleby and Turner, Sheffield.

The principal creditors are :—

	£		£
Electric Lamp Factors, Ltd. ...	£1,100	Vulcan Electric Co., Ltd.	137
Bankers	736	Accumulators of Woking, Ltd.	118
Hopkins, E.	2,754	British Thomson-Houston Co.,	
General Electric Co., Ltd. ...	604	Ltd.	115
Booth, E. G.	350	Nordisk Simpler	100
Cable Accessories Co., Ltd. ...	230		

IRONCLAD SWITCHGEAR CO., LTD.—General meeting, March 19th, at the office of Messrs. Handley, Wilde & Charlton, Bank Chambers, 9, Tib Lane, Manchester, to hear an account of the winding-up from the liquidator, Mr. W. P. Masterson.

PRYCO, LTD.—Meetings of creditors and contributories were held at Carey Street on February 14th.

Dissolutions of Partnership.—BIRLESON & LAKIN, electrical engineers, Chorley, Lancs.—Messrs. John Lakin and H. A. Birleson have dissolved partnership. Mr. Birleson will continue the business and attend to debts.

SMITH & BIRKETT, wireless and electrical engineers, 22 and 24, Wheeler Gate, Nottingham.—Messrs. S. E. Smith and A. C. R. Birkett have dissolved partnership. Mr. Birkett will attend to debts and continue the business.

WIGAN MAGNETO REPAIR WORKS, ignition engineers, 25, School Lane, Wigan.—Messrs. W. H. Shoebridge and W. Taylor have dissolved partnership. Debts will be attended to by Mr. Taylor.

JOHNSON & FRANCIS, electrical agents and merchants, 99, Frederick Street, Cardiff.—Messrs. B. G. Johnson and A. R. Francis have dissolved partnership. Debts will be attended to by Mr. Johnson.

FENTON & PEARSON, electrical factors, 1, Barton Street, Deansgate, Manchester.—Messrs. W. H. Fenton and C. S. Pearson have dissolved partnership. Mr. Pearson will carry on the business under the same style and attend to debts.

Trade Announcements.—MESSRS. GUY F. DOWDING & Co., engineers, of "Morning Post" Building, Strand, W.C., have been appointed sole agents for Great Britain and the Dominions for the Montbard-Aulnoye Tube Works, Paris; also for the Etablissements Arbel (Wagon Works), Paris, who have works at Douai and Couzon.

Messrs. H. Ashdown & Co., who have removed from Stepney, E., and merged their business with that of Messrs. Mitchell Bros., will in future trade as Mitchell Bros. & Ashdown, electrical, mechanical, and ventilating engineers, at 143, Kingsland Road, E.2. Telephone No.: "Dalston 5675."

Mr. H. E. Fugill, electrician, of Banwell, Somerset, has removed from Knightcott, to premises in West Street.

The address of the Jenner Light & Power Co., Ltd., is now 16, Hart Street, London, W.C.1.

Messrs. R. G. Badge & Son have opened a wireless accessories depôt at 57, Old Town Street, Plymouth.

The Northern Electrical and Ventilating Co., Ltd., have removed to 57, Paradise Street, Liverpool. Telephone No.: "Royal 4364."

Messrs. Allan & Mayes have opened business as electrical and wireless engineers at Crown Garage, Newmarket, Falkirk.

Messrs. George Barker & Son, of Market Street, Perth, who are re-opening their electrical department, ask for catalogues and lists of electrical accessories for lighting and power and wireless.

Messrs. R. P. Ratcliff & Co., electrical engineers and contractors, are opening new premises at 81, Wicker, Sheffield, and wish to receive catalogues of electrical and wireless accessories.

Catalogues and Lists.—The D.P. Battery Co., Ltd., Bakewell, Derbyshire.—A blotter advertising storage batteries and bearing a reproduction of a spot near the company's works.

Messrs. Ruston & Hornsby, Ltd., Lincoln.—Publication No. 4,535, containing a number of letters from users of the company's cold-starting oil engines. Also Publication No. 4,555, a list of users of these engines.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Leaflet No. B.C. 3,208, describing the "Gecophone" five-valve receiving set and accessories. Fully priced and illustrated.

Messrs. D. H. Bonnella & Son, Ltd., 58, Mortimer Street, W.1.—An illustrated and priced catalogue of electric bell accessories.

Messrs. "M.K." Electric, Ltd., Wakefield Street, Edmonton, N.18.—Two illustrated publications dealing respectively with the "M.K." safety plug and the "M.K." double-pole switch plug. Priced.

The Colebrook Electric Water Heater Co., Billiter Buildings, Billiter Street, E.C.3.—A pamphlet descriptive of the "Colebrook" electric water heater. Illustrated and priced.

The Auto Electric Co., 79, Windsor House, Westminster, S.W.1.—An illustrated description of the "Langham" 8-cwt. electric delivery van.

Dowdings' Machine Tool Registry, "Morning Post" Building, Strand, W.C.2.—A classified list of new and second-hand machine tools, with particulars of "make," condition, and situation.

Messrs. Fuller's United Electric Works, Ltd., Woodland Works, Chadwell Heath, Essex.—A set of four blotting cards bearing illustrations of the company's radio-telephony appliances and station tuning records.

Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.—Exide battery service technical letter No. 2 for motor-car dealers, entitled "Winter Operation," for inclusion in the file which accompanied the December letter.

Mr. Leslie G. Russell, 1-5, Hill Street, Birmingham.—Pamphlets advertising crystals of many kinds for use in radio receiving sets.

Messrs. L. G. Hawkins & Co., Ltd., 116, Charing Cross Road, W.C.2.—Two illustrated folders advertising a new "Universal" electric toaster.

Messrs. Hobdell, Way & Co., Ltd., 45, Church Street, Minories, E.1.—A brochure entitled "Fuel Economy by Insulation," dealing with the use of asbestos packings and coverings. Also a folder dealing with "Petro-Flex" tubing.

Messrs. James Howorth & Co., Ltd., Victoria Works, Farnworth, Bolton.—A well-illustrated booklet dealing with air filters, dust-collecting plant, heating and drying plant, steel-plate fans, &c.

The Globe Engineering Co., Ltd., Brighouse, Yorks.—An illustrated leaflet advertising explosion-proof, gas-tight d.c. motors.

The Sterling Telephone & Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—A coloured show-card advertising the "Sterling" "Threeflex" receiving set.

The Automatic Coil Winder & Electrical Equipment Co., Ltd., Wellington House, Buckingham Gate, S.W.1.—A booklet dealing with the "Avometer" and the company's coil-winding machine, and also a folder dealing with the former. Illustrated and priced.

Messrs. L. Weekes, Ltd., Langley Street, Luton, Beds.—A priced and illustrated catalogue of cartridge fuses, fuse panels and boxes, switch-fuses, mining type switchgear, &c.

Book Notices.—"The Faraday House Journal," Lent Term, 1924. London: Faraday House.—This issue contains many notes of interest to old students; articles on "The Testing of Multi-core Telephone Cables for Out-of-balance Capacity," by F. P. Pye, and "Experiments with a Magneto Lighting Set," by T. W. Hugh-Jones; book reviews; a list of appointments secured by Faradians; examination results, &c.

"The *Electrician* Electrical Trades Directory and Handbook, 1924" (pp. 1,375). London: Benn Bros., Ltd. Price 35s.—In the 42nd edition of this useful work of reference the main features remain unaltered. A great amount of revision has been carried out, and several additions have been made. Among the latter are the revised Home Office Cinematograph Regulations, new regulations made by the Electricity Commissioners, particulars of the British Broadcasting Co.'s service, and the constitution of the new Joint Electricity Boards, &c.

"Power Station Efficiency Control," by J. Bruce. Pp. xiii+244; figs. 75. London: Sir I. Pitman & Sons, Ltd. Price 12s. 6d. net.

"The *Journal* of the Junior Institution of Engineers." February, 1924. London: Percival Marshall & Co. Price 2s.—The papers reproduced in this issue are:—"Marine Propulsion During Fifty Years," by the President, Sir J. Fortescue Flannery, Bart.; "Psychology of Engineers," by Dr. C. C. Garrard; and "Some Notes on the History of the Development of Aircraft," by Mr. J. Calderwood, M.Sc. In addition, there are notes of "lecturettes," book reviews, and notes of interest to members.

"The Taxpayers' Cash Book," being an easy system of book-keeping for small businesses, with full instructions and examples for ascertaining profit and preparing accounts in support of an appeal against income tax overcharges, by A. M. Scarff. London: The Income Tax Adjustment Agency. Price 5s net.

"The Choice of Switchgear for Main and Sub-Stations," by W. A. Coates. Pp. vi+292; figs. 235. London: Blackie and Son, Ltd. Price 20s. net.

"Organisation and Administration of the Tramways Department," by S. B. N. Marsh. Pp. vii+163. London: Sir I. Pitman & Sons, Ltd. Price 6s. net.

"Small Electric Lighting Sets," by Lieut. C. F. Caunter, R.E. (Pp. 264; figs. 70.) Glasgow and London: James Munro & Co., Ltd. Price 3s. 6d. net.

"The *Mechanical World* Electrical Pocket Book and Diary, 1924." (Pp. 387). London and Manchester: Emmott & Co., Ltd. Price 1s. 6d. net.—Several sections in this edition have been re-written; among these may be mentioned those dealing with accumulators, electric welding, electric lamps and lighting, and electricity in ships. New sections have been included dealing with testing sets, electric furnaces, and thermionic valves.

Ideal Home Exhibition.—The *Daily Mail* Ideal Home Exhibition is to be opened by the Duchess of York on February 28th. It will remain open until March 22nd.

Electrical Industries in Italy.—In the tables which appeared in Major J. S. Barnes's article, on "The Condition of the Electrical Industry in Italy" (Electrical Review, February 1st, 1924), some of the figures require explanation. In both the "imports" and "exports" sections the figures given for electric lamps relate, of course, to the number of lamps, not quintals. In the exports of insulated wires and cords of 0.5 mm. dia. or less, the figures 7,355 should read 355.

Import and Export Regulations.—By an order published in the *Reichsanzeiger* a further large number of articles are allowed to come into Germany without the permit prescribed in paragraph 1 of the order relating to the regulation of imports. Among the articles affected are iron goods, railway material, &c., and other base metal products (section 17); and certain machinery and electrical goods (section 18). Another order abolishes the prohibition of export of various articles, thus further reducing the already small number of goods requiring an export permit.—*Reuter's Trade Service* (Berlin).

Copper and Lead Prices.—Messrs. F. Smith & Co. report, February 11th:—Copper (electrolytic) bars, £67 10s., 30s. increase; ditto ditto, sheets, no change; ditto ditto, wire rods, £77 10s., 30s. increase; ditto ditto, h.c. wire, 9 11/16d. 1d. increase. Messrs. James & Shakespeare report, February 12th:—Copper bar, sheet and rod, no change; English pig lead, £35, £1 increase.

Electrical Developments in Spain.—We learn, says *La Energia Electrica*, that certain financiers in Madrid and Brussels are now forming a trust of electrical companies in Barcelona, and that probably the Cataluña de Gas y Electricidad and the Productora de Fuerzas Motrices companies will join them; these are the Barcelona companies which hold the largest number of hydraulic concessions and the most important waterfalls in working. Besides these, outside the trust will remain only the Co-operativa de Fluido Electrico, which, at the moment, is treating with an English group to carry out its operations in Cataluña.

Proposed Corporation Sales Department.—A sub-committee of the Southport Electricity Committee has reported in favour of the organisation of a sales department in connection with the electricity undertaking, and the opening of a showroom. The scheme is estimated to cost £750. It is proposed to institute hire and hire-purchase systems for electrical appliances; it is not proposed to sell lighting fittings. The local branch of the Electrical Contractors' Association has appealed to the Council not to sanction the scheme, as it will affect its members' business adversely.

The Business Efficiency Exhibition.—On February 6th Lord Kylsant opened the 1924 Business Efficiency Exhibition at the Central Hall, Westminster. The show closes to-morrow (Saturday). At the opening ceremony it was pointed out that the display was the third of its kind to be held in London, although two similar exhibitions had been held in the provinces prior to these. Lord Kylsant emphasised the need for a concentrated effort by British business men to improve their methods to reduce production costs and enable them to compete on level terms with foreign manufacturers and traders. Such an exhibition was of great educational value to business men, who would obtain an idea of the best way of conducting their offices.

The exhibits are in the main similar to those seen on the previous occasions, consisting for the greater part of card indexes, calculating machines, typewriters, addressing machines, duplicators, and similar appliances. There appears to be a greater number of machines driven by small electric motors, but as the latter are rarely larger than about ¼th h.p., their effect upon the supply side of the industry is negligible. Their efficiency, however, should speak in favour of electrical methods. Inter-departmental telephone systems are exhibited by the New System Private Telephone Co., Ltd., which shows various desk and wall-type telephones; the British Home and Office Telephone Co.; and Dictograph Telephones, Ltd. Two or three firms showed motor-driven postage meters, machines for quickly franking letters and recording the number dealt with. A visit to the exhibition, which was organised by the Office Appliance Trades Association, is worth while to anybody anxious to improve his business organisation.

For Sale.—On February 28th, by order of the Admiralty, Messrs. King & King will sell by auction at the Kingston Workshops, Cowes, Isle of Wight, machinery, building materials, &c.

On February 20th, an auction sale of wireless and electrical goods will be held at the South London Merchandise Mart, York Terrace, Clapham Road Station.

The Taunton Corporation Electricity Department has steam plant, generators, &c., for disposal.

The Dublin Port and Docks Board offers disused steam generating plant for sale, including three 200-kW and one 75-kW, 500-V d.c. generators, switchboard, &c. (See our advertisement pages to-day.)

Recent Contracts.—CORRECTION.—MESSRS. TWISS ELECTRIC TRANSMISSION, LTD., state that they have not (as stated in our last issue) received the complete contract for the supply of the 36-mile, 86,000-V line from the Mulungushi River Falls to the Company's mining system, but only the contract for the supply of the necessary specially-designed lattice steel towers.

Companies associated with Messrs. VICKERS & INTERNATIONAL COMBUSTION ENGINEERING, LTD., have recently received two important orders for pulverised fuel plant ("Lopulco" system). One is for the station of the Union d'Electricité at Gennevilliers, and includes the supply of four Ladd-Belleville boilers, each of 19,500 sq. ft. heating surface working at 440 lb. per sq. in. The full-load output of steam will be 150,000 lb. per hour, and the firing with powdered coal will permit an overload output of 240,000 lb. per hour for two hours. The other order has been placed by the Société Metallurgique de Hoboken for its new power plant near Antwerp. This is the second large order recently placed in Belgium for such plant, the other being for a power station at the Charbonnages de Belringen, Limburg.

THE METROPOLITAN-VICKERS ELECTRICAL CO., LTD., has received the following orders:—For the Admiralty, spiral filament traction vacuum lamps; for the London Electric Railway, "Cosmos" 14-V 'bus lamps; for the Metropolitan Railway, traction vacuum lamps and gas-filled lamps; and for Joseph Lucas, Ltd., automobile lamps.

THE EDISON SWAN ELECTRIC CO., LTD., has received an order for metal filament tractor-type lamps from the Admiralty.

British Trade-Mark Applications.—The following are among the recent applications for British trade marks. Objections to any of the proposed marks may be entered within one month from the dates mentioned:—

Pleasure Time. No. 443,752. Class 8.—Instruments and apparatus for use in wireless signalling. General Radio, Ltd., Twyford Abbey Works, Acton Lane, Harlesden, N.W.10. February 6th.

Elastumen. No. 444,190. Class 8.—Electric cables. Johnson & Phillips, Ltd., Victoria Works, Victoria Road, Charlton, S.E. February 6th.

Dog and Rail Design. No. 443,607. Class 50.—Electrical insulators and electrical insulating substances. The Siluminite Insulator Co., Ltd., 16, Dowgate Hill, E.C. February 6th.

Brazilian Tariff Changes.—*The Board of Trade Journal* announces a number of changes in the Brazilian Customs tariff. Among the articles affected are the following, the new rate per kilogramme being stated:—"Ventilating fans, vacuum cleaners, small 'vibradores,' drying apparatus, and the like, when joined to an electric motor," 1,000 reis; "Insulating tapes for joining electric wires," 2,000 reis; and "Electric lamps," 2,000 reis. Certain goods are to be allowed to enter the country at reduced rates. Among these are materials necessary for water, gas, power, telephone, and transport undertakings run by the States, municipalities, and companies.

Commercial Secretary for Brazil.—The *Board of Trade Journal* states that the Commercial Secretary for Brazil (Mr. E. Hambloch) has removed his offices to Avenida Rio Branco, No. 37, Rio de Janeiro.

The Working Day in U.S. Steel Trades.—Judge Elbert Gary, chairman of the Board of the United States Steel Corporation, has informed President Coolidge that the elimination of the twelve-hour day in the steel industry has increased the cost of production approximately 10 per cent. Improvements and inventions in the manufacture of steel, Mr. Gary said, may reduce the additional expense somewhat, but the industry has been placed on a higher cost basis as the result of the shortening of the working day.—*Reuter's Trade Service.*

British Empire Exhibition Notes.—The Exhibition authorities have come to an arrangement with the railway companies whereby exhibits sent to the Exhibition will be carried at half the ordinary rates at owners' risk. Similarly, goods will be carried back after the Exhibition on the same terms. Certificates will be issued by the Exhibition authorities to exhibitors who wish to avail themselves of this important concession.

THE BRITISH-THOMSON-HOUSTON CO., LTD., has published a sheet, in the manner of an old print, depicting the site of the Exhibition and showing the positions of the principal buildings. The quickest way of getting to the Exhibition from any part of London and the suburbs is also indicated. The reverse, in addition to an advertisement of "Mazda" lamps, presents a number of interesting illustrated notes on the display.

LIST OF EXHIBITORS.—The list in our last issue did not contain the names of the London Electric Firm, the Electric Heating Co., and Electrical Utilities, Ltd., who are exhibiting, although their names were not in the last list published by the Exhibition authorities.

Glow Lamp Prices in France.—Despite the progressive depreciation of the franc in relation to the currency of other countries and the increased cost of raw materials, the makers of electric lamps have made no alteration in the sale prices of electric lamps since 1922. The recent further depreciation of the franc and the financial measures proposed by the Government will have a further unfavourable effect upon the costs of production of lamps. But notwithstanding these circumstances the lamp makers consider that it is a national duty to make any sacrifice necessary to prevent an increase in the articles of first necessity and to avoid any pretext on the part of merchants, &c., to import foreign lamps. The makers have therefore decided, at a meeting held at the offices of the Syndicat Professionnel des Industries Electriques, on February 1st, to postpone to the utmost limit possible any advance in prices and to leave present quotations in force.

French Companies.—The following companies have increased their capital:—Société d'Eclairage Electrique de Cannes, from 1,110,000 fr. to 3,330,000 fr.; Energie Electrique Oléronnaise, from 1,000,000 to 1,200,000 fr.; Société d'Eclairage, Chauffage et Force Motrice de Montbéliard, Audinot et Extensions, from 2,600,000 to 3,000,000 fr.; Société d'Electricité pour la Lumière et la Force, from 350,000 to 500,000 fr.; Société Electrique de Carnac, from 22,000 to 35,000 fr.; the Compagnie d'Eclairage de Chalon-sur-Saône et Mâcon has decided to embody four other local companies and take the title of Gaz et Electricité du Sud-Est, at the same time raising its capital to 15,500,000 fr.; the Société Electrique de Belchamp, from 2,000,000 to 3,000,000 fr.; the Omnium Régional d'Electricité, from 1,500,000 to 2,500,000 fr.; and the Comptoir Générale de l'Electricité, from 700,000 to 1,000,000 fr.

The Téléphones Burgunder is the style of a company formed at Paris (48, Avenue Félix Faure), for the manufacture of telephonic and telegraphic apparatus. Its capital is 500,000 fr.

The Société des Perfectionnements Industriels has been established to manufacture and trade in electrical apparatus, and more particularly in the Filtrators of the English company, Filtrators, Limited. The capital is 500,000 fr. in 500-fr. shares, 350 of which are allotted to the English company for the selling rights accorded. The new company's offices are at 241, Boulevard Sainte Germain, Paris.

Catalogues for Jerusalem.—We are asked to state that the Director of Public Works, Russian Buildings, Jerusalem, desires to receive regularly from manufacturers, catalogues, price lists and other advertising literature, concerning all kinds of plant, tools, instruments and materials, requisite for general public works, including road building, water and electricity supply, building construction, drainage, &c.

New Municipal Showrooms.—The Hackney Electricity Committee has revised the plans for the erection of a showroom and offices which were presented to the Borough Council in October last. Provision is being made for future developments, and the estimated cost is thereby increased from £26,000 to £38,500. The Finance Committee has approved the scheme, and recommended application to the Electricity Commissioners for sanction to borrow the necessary amount.

Social.—On February 1st, the staff of the MULLARD RADIO VALVE CO., LTD., held a *soirée*, including a dance. Mr. S. R. Mullard, managing director of the company, was present, and a most enjoyable evening was spent.

Lighting and Power Notes.

Accrington.—ELECTRICITY SUPPLY.—At a recent meeting of the Town Council, the chairman of the Electricity Committee stated that there had been increases in the demands for electricity from all sources, and there were applications in hand which would necessitate considerable extensions of plant. On several occasions during the winter the maximum capacity of the plant had been reached, and it was a question as to whether it was wise to go through another winter without additional plant. The Committee has asked electrical experts to go into the matter and advise as to the best course to pursue—whether to install new plant at once or wait until another year.

Ashton-under-Lyne.—CORRECTION.—The statement under the above heading in our issue of February 1st, to the effect that the South-East Lancashire Electricity Advisory Board had drafted a scheme in connection with the supply of electricity in Ashton was incorrect. Mr. A. H. Banks, clerk to the Board, states that that body has not prepared any scheme nor made any suggestion in the matter.

Barrow.—LOAN SANCTIONED.—The Town Council has received the sanction of the Electricity Commissioners to the borrowing of £9,000 for electricity purposes. The Electricity Committee has adopted heads of agreement for the supply of electricity in bulk to Grange-over-Sands.

Birkdale.—ELECTRICITY IN BULK.—A sub-committee of the Southport Electricity Committee has been in negotiation with the Birkdale District Electric Supply Co., and subject to the approval of the Council, the company, and the Electricity Commissioners, Southport will provide a bulk supply to the Birkdale company for a period of 15 years, with a minimum annual payment to the Corporation of £1,000 per annum.

Burnham (Essex).—ELECTRICITY SUPPLY.—At a recent meeting of the Urban District Council a letter was read from Messrs. Booth & Brooks, of the Mildmay Iron Works, Burnham, asking if the Council would give its support to an application for powers to supply electricity to the district. The Council decided to inform the firm that the proposal would be considered on the receipt of further particulars of the scheme.

Burnley.—LOAN SANCTIONED.—The Electricity Commissioners have sanctioned the borrowing of £12,400 by the Town Council, part of the estimated cost of proposed extensions in Rosegrove and Lowerhouse. Formal consent has also been given to the establishment of a main transmission line from the generating station to the proposed sub-station at Rosegrove.

Canada.—HYDRO-ELECTRIC DEVELOPMENTS.—Sir Adam Beck, chairman of the Ontario Hydro-Electric Commission, has plans for extending the scope of the municipally-owned power system of the province. He states that the Commission will shortly present the following proposals to the Ontario Cabinet for its authorisation:—Sets Nos. 9 and 10 of the Chippawa plant, which would bring the total capacity by 1926 up to 965,000 h.p.; from 10 to 12 million dollars to inaugurate the policy of auxiliary steam plants; and for approval to the construction of a dam to be located near Norrisburg, which would make possible the development of 700,000 h.p. on the St. Lawrence River.—*Reuter's Trade Service* (Chippawa).

With reference to the paragraph in the above note dealing with steam stand-by plant, it is of interest to note that in a recent statement Sir Adam Beck foreshadowed the installation of auxiliary steam plant to the extent of 40 per cent. of the hydro-electric power developed. It was proposed first to erect a large steam station in Toronto with a capacity of about 100,000 h.p. and capable of extension to 300,000 h.p. at a cost of from eight to nine million dollars. This would render available power which is urgently needed by a number of municipalities.

ELECTRICITY SUPPLY STATISTICS.—In statistics published in *Natural Resources*, an official Canadian journal, it is shown that Canada is second in respect of production of electrical energy per capitum among the countries of the world. The actual annual production is 683 kWh per head. Switzerland is first with a figure of 700. Other countries have productions as follows:—Norway, 493; United States, 472; and Sweden, 364. Over 88 per cent. of Canada's electricity is produced by means of water power; hydro-electric development represents 938 h.p. per thousand of population.

Chelmsford.—OPPOSITION TO BILL.—The Town Council has decided to oppose the County of London Electric Supply Co.'s bill, which seeks powers to supply electricity in Essex.

Clacton-on-Sea.—LOAN.—The Urban District Council has received the sanction of the Electricity Commissioners to a loan of £4,500 for mains, meters, and services. The Council has resolved to oppose the Bill promoted by the County of London Electric Supply Co., Ltd., for the supply of electricity in the county of Essex.

Crook.—INAUGURATION OF SUPPLY.—The sub-station of the Urban District Council was formally inaugurated on February 9th. The plant consists of two 75-kVA transformers, with switchgear. The electrical energy is obtained from the Bankfoot power station of the Northern Counties Electricity Supply Co., Ltd., at 3,000 V, and transformed down to 440 V for power and 250 V for lighting. The consulting engineer is Mr. J. E. Favel, Newcastle, and the resident engineer Mr. J. S. Forster.

Derby.—NEW PLANT.—The Town Council has decided to extend the electricity works at an estimated cost of £90,000. It is suggested that a 10,000-kW generator be installed at an estimated cost of £40,000. Other items are: Mains, £30,000; motors, £5,000; transformers, £5,000; and motor-converter, £3,500.

Dumfries.—LOAN SANCTIONED.—The Town Council has received the sanction of the Electricity Commissioners to a loan of £16,045 for extending the power station and plant.

Faversham.—ELECTRICITY SUPPLY.—The Town Council, after receiving a report from the electrical engineer as to the extension of the plant at the electricity works by the installation of either a 300- or 500-kW set, has decided to ascertain whether the Canterbury Town Council would be prepared to supply electricity in bulk, and, if so, at what all-in price for, say, 500,000 kWh per annum.

Gloucestershire.—ELECTRICITY ORDER.—The Electricity Commissioners have made a Special Order and submitted it to the Minister of Transport for confirmation, permitting the West Gloucestershire Power Co., Ltd., to supply electricity in certain districts in the County of Gloucester.

Heysham (Lancs.).—STREET LIGHTING.—Sub-committees from the Urban District Council and the Morecambe Corporation are in consultation with a view to the conversion of street lighting at Heysham from gas to electricity.

Irish Free State.—PARLIAMENTARY BILLS.—Plans, &c., have now been deposited in the Private Bill Office of the Irish Free State Oireachtas, at Leinster House, Dublin, concerning the following four undertakings:—(1) Dublin electricity supply; (2) East Leinster electricity supply; (3) Irish hydro-electric and peat power; and (4) Sligo electricity scheme.

MOUNTMELLICK AND PORTLAOIGHISE (QUEEN'S COUNTY).—The Mountmellick Rural District Council proposes to introduce electricity in the two towns of Mountmellick and Portlaoighise, and is inviting quotations from electrical engineers for the preparation of plans and maps in connection with the undertakings, and to supervise and direct the carrying out of the schemes in due course.

Leeds.—LOAN.—The Electricity Committee has recommended that application be made to the Electricity Commissioners for sanction to the borrowing of £350,000 for mains during the next three years.

Maidenhead.—NEW PLANT.—The Town Council has applied to the Electricity Commissioners for permission to install a 200-kW dynamo at the electricity works at an estimated cost of £4,500.

Malvern.—ELECTRICITY IN BULK.—The Worcester City Council has decided to provide a bulk supply of electricity to the Council. The Worcester electrical engineer reports that he has succeeded in concluding arrangements with the whole of the property owners for wayleaves across their property, except the Malvern Council itself, which owns and occupies some land near the terminus of the transmission line.

Morecambe.—ELECTRICITY AGREEMENT.—An agreement has been reached between the Corporation and Lancaster for a bulk supply of electricity from Lancaster to Morecambe, in addition to the generation at its own works.

Nelson.—LOANS.—The Town Council is applying to the Electricity Commissioners for sanction to the borrowing of the following amounts:—£21,830 for mains and sub-station equipment; and £7,810 for water-tube boilers and boiler-house extensions.

Northern Ireland.—BELFAST.—Important developments in connection with the Council's electricity supply were outlined by Alderman Oswald Jamison, in moving the adoption of the Electricity Committee's minutes at a recent meeting of the City Council. A resolution was passed applying to the Electricity Commissioners for Northern Ireland for sanction to a loan of £139,000 for e.h.p. cables from the new harbour station to the Chapel Lane sub-station, and the building of a new sub-station in Shankill Road; the building of transformer stations in the Falls Road and Cliftonville; and the connecting of these sub-stations with the Shankill Road station and the Harbour power station. The extensions would enable the Committee to close the East Bridge Street station, which would mean a saving of £19,000.

Poulton.—PROPOSED ELECTRICITY SUPPLY.—The Blackpool Electricity Committee has offered a supply of electricity to the Urban District Council on the same terms as made to Thornton. These are 20 per cent. above the Blackpool tariff for ten years, and 10 per cent. afterwards.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

LONDON.—*St. James' and Pall Mall Electric Light Co., Ltd.*—As from the reading of the meters for the Christmas quarter of 1923, the following scale will be instituted:—Lighting: For the first 4,000 kWh per annum, 5½d. per kWh.; for all consumption in excess of this, 4d. per kWh. Power: 1½d. per kWh, with a fixed charge of 7s. 6d. per h.p. per quarter.

Heating: 1½d. per kWh. As from Lady-day the charge for power and heating will be reduced to 1½d. per kWh.

SOUTHPORT.—Lighting: Maximum demand system, from 8d., 5d., and 2d. per kWh to 7d., 5d., and 1½d. per kWh.

Padiham.—PROPOSED POWER STATION.—A meeting of the Mid-Lancashire Electricity District Interim Advisory Board was held at Blackburn on February 4th. The report of the Engineers' Advisory Committee appointed to consider the applications by Burnley Corporation and the Lancashire Electric Power Company regarding the power station at Padiham was received. It was decided to recommend the Electricity Commissioners to grant the application of the Burnley Corporation. A committee was appointed to prepare standing orders for the Board, and the next meeting was arranged to be held at St Annes on May 5th.

Salford.—IMPROVEMENT OF SYSTEM.—The Finance Committee has approved a proposal of the Electricity Committee to borrow the sum of £6,900 in order to meet the increased demand for electricity in the Urban District of Prestwich, and to improve the supply of electricity in that district.

Somerset.—ELECTRICITY SCHEME.—A scheme has been drawn up by Mr. J. G. Royce, electrical engineer, for supplying a wide area in Somerset with electricity. It is proposed to erect a power station at Fordingbridge (Hants.) from which a supply in bulk would be given to the various authorities. It is proposed to erect a h.p. cable from Castle Cary to Somerton, through certain parishes in the rural district of Langport, and the Rural District Council has been asked to support an application to the Electricity Commissioners for a Special Order, authorising Mr. Royce to carry out the scheme. The original plan to erect a small station at Somerton has been abandoned.

Southport.—PROPOSED NEW PLANT.—The borough electrical engineer has reported that he anticipates difficulty in meeting the full steam requirements next winter, as recently during a heavy load period all the available boilers were in service. He suggests that steps be taken immediately to extend the boiler-house equipment.

Tamworth.—PROPOSED ELECTRICITY SUPPLY.—In connection with a suggested electricity supply to the borough, the Council has decided to submit to an electrical expert for consideration a scheme of the Pooley Hall Colliery Co., and also any proposals put forward by the Leicestershire and Warwickshire Power Supply Co.

Truro.—ELECTRICITY SUPPLY.—Messrs. Close Brothers & Co., Ltd., of Basildon House, Moorgate, London, have informed the Town Council that it is their intention to form the Truro Electricity Co., Ltd., which will apply for an Order for the generation and distribution of electricity. The cost of the works and plant at the initial stage would be about £14,000, and the Corporation would be entirely relieved of capital expenditure. Subject to the support of the Council and the approval by the Electricity Commissioners, the scheme would be commenced without delay, so that a supply of electricity would be available by next autumn. The prices charged would not exceed 10d. per kWh for lighting and 5d. per kWh for other purposes.

Ulverston.—ELECTRICITY IN BULK.—At a recent meeting of the Urban District Council the proposal to take electricity in bulk from Barrow Corporation was discussed, and it was decided to submit a supplementary report, with a revised estimate of the cost of the distribution mains to the Electricity Commissioners. The Clerk stated that the Electricity Commissioners had been requested to hold a public inquiry into the application. The new estimate was £11,688, as against £12,500 previously.

Warrington.—ELECTRICITY ORDER.—The Electricity Commissioners have made an Order authorising the Corporation to supply electricity within the Warrington rural district.

Wigan.—PROPOSED CHANGE-OVER.—The Town Council is applying to the Electricity Commissioners for sanction to the borrowing of £21,000 for the purpose of changing over the system of electricity supply from d.c. to a.c.

Wirral.—SPECIAL ORDER.—Application is being made by the Wirral Rural Council to the Electricity Commissioners for a Special Order authorising it to supply electricity in the rural district of Wirral, and the urban district of Neston and Parkgate.

Tramway and Railway Notes.

Darlington.—PROPOSED RAILLESS CARS.—The Tramways Committee has under consideration a proposal to substitute railless cars for the present tramway system, and has decided to ask Mr. A. Baker, general manager of the Birmingham Corporation tramways, to visit the town and explain the system in operation in Birmingham.

Keighley.—RAILLESS CARS.—The Corporation's scheme to replace the entire tramway system by railless services, the opposition to which by the West Riding County Council is now withdrawn by an agreement as to responsibility for road repairs, is progressing, and the placing of orders for the railless cars has been authorised by the Town Council. A provisional Order is being sought from the Ministry of Transport.

London.—STOCKWELL STATION IMPROVEMENTS.—The tubular shafts for the reception of the escalators at Stockwell have now been completed, and the work of installing the escalator machinery is proceeding. The escalators will be of the reversible type, so that both may operate in the same direction if and when required. The journey from the booking hall to the platform will occupy only 55 seconds. One of the principal improvements will be the much increased size of the booking hall. The new hall will have an area of 3,000 sq. ft. as against 600 sq. ft. in the old station, and passimeters will displace the old method of booking.

A multiple escalator equipment by which three distinct moving stairways will work in one shaft, and having many other improvements over the type of escalator now in use in London, including a novel and much simpler method of boarding and alighting for passengers, is being installed at the new Clapham Common station on the reconstructed City and South London Railway. Another advantage of the new escalator is that any or all of the three staircases can be made to go in either direction at the same time, and they can be reversed practically instantaneously. The new escalator is known as the "Comb Type," because by an ingenious grill-like arrangement in the top and bottom platforms passengers will be picked up and set down instead of having to steady themselves before stepping. The sideway step-off as a passenger alights from the existing type of escalator is eliminated. Passengers will just walk on and off. Increased circulating space is also provided by the improved landing arrangements of the new escalator. Those at Clapham Common will give direct connection between the booking hall and the platform. The old station is being done away with because the site is unsuitable for further development. A new station is rapidly nearing completion on the north side of Clapham Common. The latest ticket-issuing equipment and the other improvements which have been planned will enable the station to deal with 30,000 passengers a day as against 14,000 at the old station.

L.C.C. TRAMWAYS.—The Highways Committee has considered the various points put forward by Mr. W. C. Johnson (on behalf of Mr. J. D. Gilbert) at the L.C.C. meeting held on November 13th last, and reports as follows:—The risk of loss involved in increasing the distances for all fares is too great to justify any immediate alteration. The re-introduction of halfpenny fares is considered impracticable. Attention has been devoted to the question of introducing a halfpenny fare for one section during the middle of the day when the cheap 2d. fares now apply, and the risk of loss is estimated at £52,000 per annum. The re-instatement of transfer and return tickets and the introduction of season tickets is inadvisable. Return fares have already been instituted, but as they only came into operation on January 1st, it is too early to judge of the effect upon revenue.

The question of heating the Council's cars electrically has been studied, and the Highways Committee reports that the cost of equipping the cars with electric radiators would be £35 per car. The cost of operation would be considerable, as the energy consumption would represent ¾d. per car-mile. The whole of the cars (1,550) would require 15,500 kWh per hour, which would necessitate the installation of additional generating plant, sub-station equipment, and cables, the cost of which is estimated at several hundreds of thousands of pounds. In the circumstances the Committee has decided to take no further action in the matter.

Manchester.—PROPOSED TUBE.—The Corporation has appointed a special committee to consider the possibility of an underground railway in the city. The estimated cost of the proposed scheme is £25,000,000. It is stated that the tramway services now carry 300 million passengers a year, and the revenue is £2,500,000, which is 10 per cent. of the estimated outlay required for the tubes.

TRAMWAY EXTENSIONS.—In connection with the proposal to insert a clause in the Corporation Parliamentary Bill for powers to run cars up and down Portland Street and along Peter Street to Deansgate, a poll of ratepayers has resulted in a majority of 4,024 in favour of the inclusion of the clause. The poll was necessitated by the defeat of the proposal at a recent town's meeting.

Plymouth.—NEW CARS.—Owing to the narrowness of the gauge, which is only 3 ft. 6 in., the Ministry of Transport has refused to sanction the adoption of covered double-deck tramcars on the Corporation tramways. At present no covered-in cars are in use. The Ministry points out that the gauge required for the type of car desired to be adopted is 4 ft. 8½ in., and that the severe gradients and many turnings of the Plymouth system influenced it in withholding permission. Twenty new cars of another type have therefore been purchased and will be placed in service at the end of March. These are of the vestibule type, giving protection to the motor-man and conductor, with a total seating capacity of sixty, compared with fifty in the present type of cars. A corresponding number of the oldest cars are to be scrapped.

Telegraph and Telephone Notes.

Empire Radio Communication.—NEW ADVISORY COMMITTEE.—The Postmaster-General has appointed the undermentioned Committee to consider and advise him without delay on the policy to be adopted as regards Imperial Wireless Services so as to protect and facilitate public interest:—Mr. Robert Donald, LL.D. (chairman); Mr. F. J. Brown, C.B., C.B.E., Post Office; Prof. W. H. Eccles, D.Sc., F.R.S.; Sir Drummond D. Fraser, K.B.E.; Sir Henry H. Slesser, K.C., Solicitor-General. Mr. W. E. Weston, Post Office, will be secretary to the Committee.—*Financial News.*

India.—IMPERIAL RADIO COMMUNICATION.—As we foreshadowed in our note of February 1st, the High Commissioner for India states that the following *communiqué* was published by the Government in India on February 5th:—The Government of India is prepared to enter into an agreement and to grant licences to private enterprises in India for the establishment and operation of the necessary radio service to provide the Indian link in the Imperial wireless scheme and also commercial radio communication with other parts of the world. Applications will be accepted up to August 1st next, and successful applicants will be required to register a company in India, at least 60 per cent. of the capital of which must be offered in India. The service required entails the installation of a station capable of conducting high-speed duplex radio communication in two directions simultaneously, together with simultaneous reception from at least three other directions, at a rate of charge which shall not exceed the cable rates from time to time prevailing. Direct communication with the United Kingdom or South Africa on the one hand, and Australia or Canada on the other, must be guaranteed. The terms of the agreement and the conditions governing the grant of licences may be obtained on application from the Director-General of Posts and Telegraphs, Wireless Branch, Delhi.—*The Times.*

RADIO TELEPHONY.—The Bombay Port Trust has decided to install four radio telephone sets for the purpose of communicating between Ballard Pier, Kennery Island, Prongs Lighthouse and the pilot ship. This will be the first installation of its kind in India. The Indian States and Eastern Agency, agents in India for the Marconi Co., has been entrusted with the contract.—*Indian Engineering.*

International Telephone and Cable Trust.—PROPOSED WORLD CONTROL.—With further reference to this subject and the American T. & T. Co.'s denial published in our last issue, the *Financial Times* explains that further news to hand regarding the International Telephone and Telegraph Co., which has been formed to consolidate telephone interests throughout the world as well as telegraphs and cables, states that at the recent Board meeting representatives of the All-Americas Cables, Inc., which already owns 21,300 miles of cable between North and South America, were elected to the directorate. The latter company has recently purchased the French West Indian cable system known as the United States and Hayti Telegraph and Cable Co. in New York, from the French Government, and also secured an agreement with the United States State Department terminating the British monopoly of cable communication on the east coast of South America held by the Western Telegraph Co., one of the Eastern Telegraph Associated Companies group. This powerful combine already controls telephone communication in Cuba, Porto Rico, and Uruguay, as well as in certain parts of the Argentine, Chile, and other South American countries, and is considered to be a serious rival to the American Telegraph and Telephone Co., despite the fact that it is already part owner with the latter of the Florida-Cuba telephone cable.

The *T. and T. Age* records the election of representatives of the National City Bank, All-America Cables, Berwind-White Coal Co., and other big interests on the board of directors of the International Telephone and Telegraph Co., which is understood to be the moving spirit in the enterprise to consolidate telephonic communication systems throughout the world. The Government is in possession of information indicating that consolidation is being actively pressed in several countries on the U.S.A. side of the Atlantic, and that some progress has been made in European countries. While considerable opposition has been met in European countries, the attitude of Latin American Governments which operate their own telephone systems, either in whole or in part, is understood to be favourable to the project.

Portugal.—STRIKE OF TELEGRAPH EMPLOYES.—The Government is taking all necessary measures to minimise the consequences of the strike of telegraphists and postal employés. —*Reuter* (Lisbon).

Siam.—TELEPHONE SERVICE.—The number of new telephones installed in Siam during the eleven months ending November last was 126, bringing the total up to 1,279 in Bangkok and 63 at interior points in the country.

The Telephone Service.—NEW EXCHANGE.—A new telephone exchange is to be opened at Golders Green, and, while the London telephone authorities suggest "Speedwell" as a suitable name, the Hendon Council prefers "Brent."

West Indian Cables.—PROPOSED DISPOSAL.—The Compagnie des Cables Telegraphiques has convened a meeting for February 23rd for the purpose of considering a proposal to authorise the directors to dispose of the company's West Indian cable, concerning which negotiations have been proceeding with an American group for some time past. It is reported that the price to be paid for the cable is approximately 2,500,000 dollars.

Radio Notes.

United States.—RADIO IN MINES.—Full power to investigate the possibilities of radio as a means of saving lives in mine disasters was vested in the international officers of the United Mine Workers of America by a resolution adopted at the International Convention at Indianapolis on January 25th. Recent experiments carried on at Scranton, Pa., demonstrated the practicability of radio being operated successfully 1,000 ft. underground, and the international officers were called upon to investigate the feasibility of maintaining and operating sending or broadcasting radio sets down in the mines to notify the world of any accident or disaster.—*Reuter's Trade Service* (Indianapolis).

NEW BROADCASTING STATION.—The General Electric Co.'s new radio broadcasting station (KGO) in Oakland, Calif., was officially opened on the evening of January 8th. This station, which is at present using 1,000 watts, is capable of using twice that power, and is provided with remote controls by means of which music and entertainment may be picked up from theatres and halls in Oakland and other nearby cities. Steel towers 150 ft. high support the antenna, and under the antenna but about 14 ft. above the ground is a network of wires covering an area of approximately 150 ft. by 300 ft. The power house is also beneath the antenna system, and contains six large motor-generators and other equipment. KGO will broadcast on Tuesday, Thursday, and Saturday evenings from eight to ten o'clock, operating on 312 metres. This is claimed to be the largest radio broadcasting station in the world.—*Journal of Electricity.*

Radio-Broadcasting.—SOME TECHNICAL PROBLEMS.—At Manchester on the 4th inst. Capt. P. P. Eckersley, chief engineer of the British Broadcasting Co., addressed a joint meeting of the local centres of the Institution of Electrical Engineers and the Institution of Post Office Engineers on "The Technical Problems of Broadcasting," in the course of which, according to the *Manchester Guardian*, he assured them that the difficulties that had to be contended with were greater than were imagined. Morse jamming had brought innumerable complaints from many places. The Postmaster-General could do nothing, because the maritime service had to be carried on. The only remedy was to make the broadcasting louder, and as, with their restricted licence, they could not increase the kilowatts, there was nothing for it but the erection of relay stations connected by land-wire.

The great majority of users in this country were crystal users. The Broadcasting Co. had set out definitely to study the majority, and the object of relay stations was to enable crystal users to enjoy the same advantages as valve users. There was not, he thought, a single cable at present capable of taking the high frequency required for broadcasting purposes, but in the future it was possible that all the present difficulties arising from induction noises, cross-talk, overhearing, &c., would be overcome by means of "wired wireless"—the superimposing of high-frequency currents on land lines—a matter which was now engaging their attention. The B.B.C. was to erect a number of additional relay stations in various parts of the country—one between Leeds and Bradford, one at Liverpool, one at Hanley, and one at Edinburgh—at each of which it was hoped to experiment with "wired wireless."

Another difficulty they had to contend with was oscillation. It was possible, through oscillation, to interfere with an area of 75 square miles, but many people were quite unconscious that they were responsible for oscillation. He was of the opinion that there were more faults due to defective reception than to defective transmission. Many people complained that there was too much simultaneous broadcasting, but he pointed out that only 25 per cent. of their total time was taken up with simultaneous broadcasting.

SIMULTANEOUS TRANSMISSION.—Simultaneous broadcasting, which has been such a prominent feature of the B.B.C. programmes for the last four or five months, is to be curtailed considerably in a few days' time, and will, for the next few months at any rate, occupy a much smaller part of the broadcast programmes. This step has been decided upon by the control committee of the B.B.C. in view of the fact that a technically simultaneous broadcast transmission, although it has been the medium of radiating many excellent concerts from London and the provincial stations, has not been wholly successful where the more subtle elements of music have been concerned, and sooner than permit the quality of the transmission to be depreciated in this way, the committee has decided to rely more upon the local stations for the provision of musical programmes. Simultaneous broadcasting will, however, be continued for the transmission of musical events of outstanding interest from London or the other sta-

...; the latter will continue to be served from London with ...ce music, the weekly talks of the B.B.C. art critics, time ...nals, news bulletins, &c. The chief features which will for ...e time being disappear, are the "S.B." concerts on Sun... afternoons and the symphony concerts on Monday even..., which will be replaced by music from the local stations. ...nwhile every effort is to be made to overcome, or at least ... minimise, the difficulties presented by the use of the Post ...ffice trunk lines. These difficulties have been very pro...nced, but the Post Office and B.B.C. engineers are co...erating in an endeavour to reduce the bugbear of distortion, ...large amount of parasitic noise, and a loss of strength (which ...often very considerable), which at present seem inseparable ...m the use of many hundreds of miles of trunk line, and ...nnot be compensated for at the receiving end without the ...stortion being amplified also. Underground cables have ...eir own particular difficulties, and it is a strange fact that ...the line between London and Birmingham, which runs ...r very much of the distance underground, transmission can ...e made quite satisfactorily one way—from London to Bir...ingham—but in the reverse direction it is so completely un...isfactory that programmes are not relayed from the Mid...nd station to London. The alternative to the use of land ...nes is wireless itself, but such a method would introduce ...mospheric disturbances and the "mush" of Morse code, ...o that simultaneous broadcasting is not likely to be developed ...ong these lines.

SHEFFIELD RELAY STATION.—After several weeks of experi...ent the Sheffield relay station is now permanently linked ...ith the Birmingham broadcasting station by landline. The ...l receiving station at Greenhill, which used to pick up the ...anchester station for relaying, will not be dismantled, but ...ill be employed for further experimental work.—*Daily Mail.*

South Africa.—BROADCASTING STATION.—The Associated ...cientific and Technical Society of South Africa has decided ...o open a permanent broadcasting station which will probably ...e operating in a month's time.—*Reuter* (Johannesburg).

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed ...velope.

We should be glad to learn the names of makers or suppliers ...f:—

NALLA two-pin lamp socket adapters.
Giant globe strain insulators (made of mica or formalite).
A thermo-pile capable of charging a small accumulator.
EXCELLO arc lamps and carbons.
Carbon cloth for variable resistances.
Self-vulcanising insulating tape.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph ...dicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Australia.—MELBOURNE.—March 19th. Victorian Railways. ...One electrically-driven air compressor.*
Alternating-current induction motors, starting apparatus, ...nd accessories.*

Barking. — February 19th. Electricity Department. ...Feeder and distributor cables. (February 1st.)

Belfast.—March 4th. Tramways Committee. Twelve ...months' supply of stores, including cable, lamps, carbon ...rushes, &c. (February 8th.)
March 10th. Electricity Department. Supply and laying ...f e.h.p., 3-phase cables, and the supply and erection of ...,000-kW rotary converters with transformers, switchgears, ...c. (See this issue.)

Belgium.—Tenders have this week been invited by the ...unicipal authorities of Lierneux (Province of Liége) for the ...oncession for the supply of electricity in the town.
February 21st. Municipal authorities of Brussels. Bronze ...able connectors for 12 months and supply of circuit-breakers. ...Specifications in respect of the two contracts can be obtained ...or 2 fr. each.
February 26th. Provincial Administration of Western ...Flandere. Tenders for the supply and erection of an electric ...power distribution system for the communes of Nieu...port, Coxyde, Furnes, Dixmude, Moere, and Ostend. The ...contract includes the installation of aerial high-pressure lines ...with all accessories, construction and equipment of the trans...former cabins, and the supply and laying of an underground ...high-pressure line.*
February 25th. Schaerbeek Municipality. Supply of 1,000 ...5-amp., 110-V. single-phase electricity meters; and 500 metres ...of 3 x 30 x 20 armoured cable. Particulars from the Service ...de l'Electricité, Hotel Communal, Schaerbeek.

Birmingham.—February 16th. Electricity Committee. Supply of d.c. motors (approx. 250, from ¼ b.h.p. to 20 b.h.p.); starting panels. (February 8th.)

Blackburn.—March 1st. Board of Guardians. Electric lighting and power installation at the Institution laundry. Deposit £1 (returnable). Mr. C. E. Bygrave, Clerk, Union Offices, Blackburn.

Bradford.—February 21st. Electricity Department. Five 2,500-kVA, 3-phase transformers; m.p., d.c. switchgear; 6,600-V armour-clad switchgear, &c. (February 1st.)

Caistor (Lincs.).—February 16th. Board of Guardians. Electric lighting installation at the Institution, including engine, dynamo, wiring, &c. Mr. A. A. Padley, Clerk, Union Offices, Caistor.

Carlisle.—The Electricity Department has for sale two Willans-Peebles steam dynamos. (See this issue.)

Colwyn Bay and Colwyn.—March 6th. Urban District Council. Sewerage pumping machinery, including three 10-b.h.p. electric motors. Mr. Robt. Green, chartered civil engineer, 37, Bennett's Hill, Birmingham.

Croydon.—March 3rd. Electricity Department. E.h.p. switchgear; cooling towers and ponds; and cast iron circulating piping. (See this issue.)

Denmark.—COPENHAGEN.—April 2nd. Lighting Department. 6,000-V and 30,000-V switchgear.*

Dover.—March 17th. Electricity Department. One water-tube boiler. (February 8th.)

Dundee.—February 21st. Electricity Department. Two- and three-core 660-V, paper-insulated, lead-covered and armoured cables. (See this issue.)

Dun Laoghaire (Kingstown) (Co. Dublin).—February 28th (extended from 21st). Urban District Council. Crude oil engines and alternators; switchgear and transformers, distribution system (underground and overhead). (February 8th.)

Dundonald.—Lochgelly Iron and Coal Co., Ltd. Various works, including electric lighting, required in the erection of 40 houses, and a new street. Schedules from Mr. A. D. Hoxton, architect, Leven.

Edinburgh.—Education Authority. Work, including electric lighting, in connection with new elementary school, James' Place, Leith. Schedules from Mr. J. M. Johnston, architect, 47, Charlotte Street, Leith. Tenders to Mr. John Stewart, S.S.C., executive officer, Education Offices, Edinburgh.
March 10th. Electricity Department. One 1,500-kW and two 500-kW converters. (See this issue.)

Falkirk.—Electric lighting work in connection with 52 houses at Thornhill site. Specification, &c., from Mr. A. Balfour Gray, Town Clerk.
Electric lighting work in connection with housing scheme (second development) (80 houses). Written application to Mr. Wm. Gibson, Director of Housing, Arbotdale, Falkirk.

Glasgow.—February 18th. Electric lighting of Partick District Library. Specification from Office of Public Works, City Chambers, 64, Cochrane Street, Glasgow.

Ilford.—The Urban District Council Electricity Department invites tenders for the supply of 500-kW converting plant. (See this issue.)

Kilkee (Co. Clare).—February 21st. Supply of plant, &c., in connection with the supply of electricity to the town: —Semi-Diesel engines; dynamos and motor boosters; accumulators; switchboard; line material; street lamps; erection of lines and fittings; house service meters; and house wiring. Conditions and specifications may be obtained from Mr. L. J. Lawless, consulting engineer, 19, Percy Place, Dublin.

Leeds.—March 4th. Tramways and Highways Department. Miscellaneous materials, including (Sch. 12a) copper bonds; (Sch. 13a) electrodes.—Mr. J. B. Hamilton, commercial manager, 1, Swinegate, Leeds.
March 29th. Electricity Department. One 12,000-kW turbo-alternator set, and steam turbine-driven surface condensing plant. (See this issue.)

London.—ISLINGTON.—February 25th. Electricity Department. Two electric dust collection vehicles, fitted with steel tipping bodies, and four horse-drawn street-watering vans. (February 8th.)
HAMMERSMITH.—February 20th. Electricity Department. Twelve months' supply of stores, including electric light sundries, insulated wire, meters, joint boxes, &c. (February 8th.)
SOUTHWARK.—Board of Guardians. Electric lighting installation at the Newington Institution. (See this issue.)

Manchester.—February 19th. Tramways Committee. Permanent-way points, tongues, crossing and hardened steel centres; electrodes for welding; and general stores, including electrical items. Mr. H. Mattinson, general manager, Corporation Tramways, 55, Piccadilly, Manchester.
February 23rd. Public Health Committee. Supply, erection, and maintenance of a 112-cell storage battery at Baguley Sanatorium, Cheshire. (See this issue.)

New Zealand.—WELLINGTON.—February 26th. Post and Telegraph Department. Twenty miles of 1/20 copper wire, vulcanised-rubber, insulated, taped and braided to specification No. 116.*

Plymouth. — February 21st. Electricity Department. Electricity meters, cables (paper insulated), transformers. (February 8th.)

Rhyl.—February 22nd. Electricity Department. L.p. cables. (February 8th.)

Spain.—March 25th. The Centro Electrotechnico in Madrid is inviting tenders for the supply of an electricity generating set required in connection with a wireless telegraphy station.

Stoke-on-Trent.—March 12th. Electricity Department. Neutral earthing resistance; three steam turbine-driven feed pumps; 600-Ah secondary battery. (See this issue.)

Uruguay.—MONTEVIDEO.—March 31st. State Electricity Supply Works. Six generating sets, complete with accessories and spares, consisting of Diesel oil engines and generators directly coupled.*

Warrington.—February 18th. Electricity Department. 12 months' supply of transformers. (February 1st.)
L.p. paper and lead-covered distributing cable. (February 8th.)

Whitehaven.—February 29th. Corporation Electricity Department. A 1,000-kW geared d.c. turbo-generating set, complete with condenser pumps and pipework. (See this issue.)

Wigan.—The Tramways Committee invites offers for the disposal of scrap metal. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Bradford.—Tramways Committee.
400 steel tires for tramcars (£1,150).—United Steel Co., Ltd.
20 tons of brake shoes (£220).—National Rail and Tramway Appliances Co., Ltd.
40 tons track brake blocks (£400).—Cole, Marchent & Morley, Ltd.

Electricity Committee.
Reblading high-pressure end of No. 6 turbine.—C. A. Parsons & Co., Ltd.

Conditioning House Committee.
Provision of small power-driven elevator in the main conditioning house for conveyance of tops to mechanical press (£95).—Jessop & Boydell, Ltd.

Canterbury.—Town Council. Accepted:—
500-kW motor-converter (£2,144).—Bruce Peebles & Co., Ltd.
Installation of motor-converter, with switchgear and cable connections (£555).—May & Hawes.
2,300 yd. of cable (£1,713).—Western Electric Co., Ltd.

Colchester.—Board of Guardians. Accepted:—
Installation of electric lighting at the Institution (£220).—Trustlove & Co.

Chesterfield.—Town Council. Accepted:—
Lighting and starting set, &c., for Hunger Hill pumping station (£256), and for pumping plant for the Whispering Well pumping station (£1,820).—W. H. Allen, Son & Co., Ltd.

Erith.—Urban Council. Accepted:—
Three 50-kVA transformers (£86 each).—British Electric Transformer Co., Ltd.

Hastings.—Town Council. Accepted:—
Plant, &c., in connection with the new power station at Broomgrove :—
Buildings, cooling pond, coal bunkers, &c. (£27,721).—Fairweather and Ranger.
300-ton weighbridge (£350).—Henry Pooley & Son, Ltd.
2,000 yd. 0.6 concentric high-pressure lead-covered armoured cable (£1,180 per 1,000 yd.); 13,000 yd. 0.25 similar cable (£570 per 1,000 yd.); 0.6 joint boxes (£4 7s. 6d. each); 0.25 joint boxes (£2 17s. 6d. each); 0.6 sealing ends (£2 17s. 6d. each); 0.2 sealing ends (£2 2s. each).—W. T. Glover & Co., Ltd.
Three-phase, 6,600-volt extra-high-pressure main switchboard, non-interlocked cubical type (£2,519); combined 2-phase and single-phase extra-high-pressure main switchboard (£1,548); 3-phase, 230-240-volt medium-pressure main switchboard (£1,115).—Ferguson, Pailin, Ltd.
26 200-kVA single-phase transformers (£171 each); six 100-kVA similar-type transformers (£118 each); four 1,000-kVA Scott transformer sets, complete with self-balancing gear (£876 per set); two 250-kVA, 3-phase transformers, complete with self-balancing gear (£435 each).—Ferranti, Ltd.
Centrifugal oil filter and de-hydrator (approx. £340).—Empson's Centrifugals, Ltd.

Kettering.—Urban District Council. The following tenders were received for h.p. and l.p. cables :—

	L.p cable.	H.p. cable.	Total.
	£	£	£
British Insulated & Helsby Cables, Ltd. ...	18,659	6,549	25,208
Enfield Cable Works	18,699	6,551	25,250
Callender's Cable & Construction Co. ...	18,898	6,684	25,582
Siemens Bros. & Co., Ltd.	18,667	6,551	25,218
Union Cable Co.	18,414	6,450	**24,864**†
W. T. Henley's Telegraph Works Co., Ltd.	18,677	6,549	25,226
Johnson & Phillips, Ltd.	18,875	6,614	25,489
Western Electric Co.	18,873	6,608	25,477
Pirelli-General Cable Works Co., Ltd. ...	18,622	6,538	25,160

† Provisionally accepted.

London.—METROPOLITAN ASYLUMS BOARD.—The following tenders for the installation of X-ray apparatus at the High Wood Hospital for Children have been received. The Works Committee recommends the acceptance of the tender of Messrs. Newton & Wright, Ltd. :—

Medical Association, Ltd.	£220
Newton & Wright, Ltd. (Recommended.)	225
A. E. Dean	228
F. R. Butt & Co.	267
Cox-Cavendish Electrical Co., Ltd.	279
Watson & Sons (Electro-Medical), Ltd.	289
X-rays, Ltd.	296

Maidstone.—Town Council. Accepted:—
Cables for small extensions (£156).—Enfield Cable Co.
Transformer (£96).—Hackbridge Electric Construction Co.
Two boilers and accessories (£19,046).—Vickers-Spearing, Ltd.
The other tenders for the boilers and accessories were :—Clarke, Chapman, Ltd. (£19,193); Clayton & Shuttleworth, Ltd. (£19,445); John Thompson, Ltd. (£19,667); and Babcock and Wilcox, Ltd. (£19,992).

Manchester. — Electricity Committee. The following tenders have been accepted :—
Cable.—W. T. Henley's Telegraph Works Co., Ltd.
Motor-converter plant.—Bruce Peebles & Co., Ltd.; British Thomson-Houston Co., Ltd.

Supply of materials (among others) for the six months ending June 30th, 1924 :—
Adhesive tape.—Connolly's (Blackley), Ltd.; Pomona Rubber Co.
Box compound (h.p.).—British Insulated & Helsby Cables, Ltd.; (l.p.)—Dussek Bitumen Co.
Bittite tape.—Callender's Cable & Construction Co., Ltd.
Carbon brushes.—Le Carbone; Morgan Crucible Co., Ltd.
Crucibles.—Morgan Crucible Co., Ltd.
Dynamo brushes.—W. Christie & Co., Ltd.
Earthenware pipes.—Doulton & Co., Ltd.; Thos. Wragg & Sons, Ltd.
Fuse boxes.—Siemens Bros. & Co., Ltd.; Sykes & Dyson.
Insulators.—Bullers, Ltd.; Doulton & Co., Ltd.; Gaskell & Gregory, James MacIntyre & Co., Ltd.
Tapes, &c.—J. Bonas & Son; Siemens Bros. & Co., Ltd.
Trifurcating boxes.—British Insulated & Helsby Cables, Ltd.; Sykes and Dyson.
Tubing and accessories.—Simplex Conduits, Ltd.
Wire, d.c.c. and silk-covered.—Concordia Electric Wire Co., Ltd.
Wire, tinned-steel binding.—Bruntons, Musselburgh.
Wire, pure tin fuse.—Hawkins Bros. & Co., Ltd.
Wire, pure tinned copper.—Frederick Smith & Co.

Tramways Committee. Accepted :—
Automatic rail planer.—Equipment & Engineering Co., Ltd.
Electrically-driven air compressor.—Ingersoll Rand Co., Ltd.

Newcastle.—City Council. Accepted:—
Electrical installations for houses on the Walker housing estate.—Jesmond Electrical and General Engineering Co., Ltd. (£494); Philip William Wood (£491); T. G. Usher & Co. (£487); Reid, Ferens and Co. (£465); Falconar, Cross & Co. (£495); Robson & Coleman (£463); G. S. Douthwaite & Co. (£228); Fletcher Bros. (£467); Thomas Atkinson (£226); Gray Bros. & Co. (£235); Wilson & Ridley (£758); Arthur J. Knight (£473).

Salford.—Tramways Committee. Accepted:—
Six four-motor controllers (£86 each) and two two-motor controllers (£46 each) for bogie cars.—English Electric Co., Ltd.
2,000 yd. of l.p. cable and 700 yd. of h.p. cable (£860).—W. T. Glover and Co., Ltd.
2,500 yd. of l.p. cable (£421).—Macintosh Cable Co., Ltd.

Stafford.—Town Council. Accepted:—
100-kVA transformer (£142); switchgear in connection with new alternator (£476).—English Electric Co., Ltd.

Forthcoming Events.

British Electrical Development Association.—Friday, February 15th. At the London School of Economics. At 7.30 p.m. Salesmanship Conference.

Manchester Electro-Harmonic Society.—Friday, February 15th. At the Albion Hotel, Manchester. At 7.30 p.m. Concert

National Association of Supervising Electricians.—Saturday, February 16th. At the Holborn Restaurant. At 6 p.m. Annual dinner and musical evening.

Faraday Society.—Monday, February 18th. At the rooms of the Chemical Society, Burlington House, Piccadilly, W.1. At 8 p.m. Lecture by Mr. A. P. Laurie on "A Magnetic Theory of Valency."

Electrical Power Engineers' Association (North-Eastern Division).—Tuesday, February 19th. At the Literary and Philosophical Institute, Corporation Street, Middlesbrough. At 7 p.m. Paper on "Parallel Running of a.c. Stations," by Mr. Howarth.
Wednesday, February 20th. At the Crown Hotel, Newcastle. At 6.45 p.m. General meeting. At 8 p.m. Paper on "Parallel Running of a.c. Stations," by Mr. Howarth.

Illuminating Engineering Society.—Tuesday, February 19th. At the House of the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Discussion on "Some Aspects of Railway Lighting."

Royal Society of Arts.—Wednesday, February 20th. At John Street, Adelphi. At 8 p.m. Paper on "New Uses for Rubber," by Mr. P. J. Burgess.

Institution of Electrical Engineers.—Thursday, February 21st. At the Hotel Cecil. At 7 p.m. Annual dinner.
(Students' Section).—Friday, February 15th. At the Institution. At 6.30 p.m. Paper on "E.h.t. Switchgear," by Mr. T. J. Barfield.
(Informal Section).—Monday, February 18th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Electrical Development in France," to be opened by Mr. E. M. Malek.
(Scottish Centre).—STUDENTS' SECTION.—Friday, February 22nd. At the Royal Technical College, Glasgow. At 7.30 p.m. Address by Dr. S. P. Smith.
(North-Western Centre).—Tuesday, February 19th. At the Engineers' Club, Manchester. At 7 p.m. Paper on "Some Researches on the Safe Use of Electricity in Coal Mines," by Prof. W. M. Thornton.
(North-Midland Centre).—Tuesday, February 19th. At the University, Leeds. At 7 p.m. Paper on "Single-phase Induction Motors," by Mr. E. Barker.
(East-Midland Sub-Centre).—Tuesday, February 19th. At the Derby Technical College. At 6.45 p.m. Paper on "Recent Developments in Radio Communication," by Mr. H. V. Field.
(Mersey and North Wales (Liverpool) Centre).—Monday, February 18th. At the University of Liverpool. At 7.30 p.m. Open meeting. Popular lecture on "Radio Reception," by Prof. E. W. Marchant, D.Sc.

Physical Society of London.—Friday, February 22nd. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Papers on "A Generalisation of Whitehead's Theory of Relativity," by Mr. G. Temple. "The Structure of the Atomic Nucleus and the Mechanism of its Disintegration," by Dr. Hans Pettersen. "The Effect of a Magnetic Field on the Surface Tension of a Liquid of High Permeability," by Winifred Rolton and Mr. R. Stanley.

Birmingham and District Electric Club.—Friday, February 22nd. At the Grand Hotel, Birmingham. At 7 p.m. Lecture on "Automatic Telephony," by Mr. H. Humphries.

Institution of Mechanical Engineers.—Friday, February 22nd. At the Institution, Storey's Gate, S.W.1. At 6 p.m. Annual general meeting.

Junior Institution of Engineers.—Friday, February 22nd. At 39, Victoria Street, S.W.1. At 7.30 p.m. Lecturette, "'Ciment Fondu': Its Manufacture and Special Uses," by Mr. J. S. Marshall.

Notes.

Rubber Latex Boards.—At the Engineers' Club on February 4th a paper was read before the Institution of the Rubber Industry by Mr. F. Kaye, on the use of rubber latex in the manufacture of boards, leather and linoleum substitutes, &c., and on the vulcanisation of these products. The author pointed out that the new process should lead to the greatly-extended utilisation of rubber and to the introduction of a wide range of new products made by paper-making and board machines. Latex could be used in the manufacture of asbestos boards and boards for use in the electrical industry.

Smokeless Fuel Production.—The Corporation of Glasgow has decided to proceed at once with the erection of a five-unit battery of producers for the manufacture of smokeless fuel on the Maclaurin system. The installation, which will be erected at the Corporation's gasworks at Dalmarnock, will be capable of carbonising 35,000 tons of coal per annum, and the smokeless fuel produced will, it is hoped, be sold to the public at the same price as coal having a similar heating value. The gas produced will be used for various purposes in the works, including the firing of boilers, thus taking the place of the coke and producer gas which are used at present. The valuable by-products which it is expected will be obtained will be treated in the chemical section of the gas department. Estimates have been accepted for the construction of the plant, and work is to begin immediately.—*Times Trade and Engineering Supplement.*

A "Telephone" Inquest.—An inquest was held on February 5th into the cause of death of one Graham Buckley, aged 49 years, which occurred in Westminster Infirmary as the result of an accident in the street. The evidence showed that he had been in very low water and was admitted to the Infirmary last August. The verdict returned was "Death from Natural Causes." The Press reports stated that he "was a financier," and that "it was through his instrumentality that the telephone was introduced into this country." "He formed," so it was stated, "a company and popularised the invention." In view of these statements we ought to say that, so far as the telephone was concerned, Buckley was not a financier, and no evidence is extant that he was instrumental in popularising it. He occupied the position of secretary to a Mr. Ormes, who was indirectly concerned in the formation of some foreign and subsidiary British companies, but was more particularly identified with Mr. Eldred in the promotion of the London and Globe Telephone Co., which company endeavoured unsuccessfully to compete with the United Telephone Co. The London and Globe Co.'s existence was brief, and with it Mr. Buckley's connection with the telephone ceased.

Educational. — FARADAY HOUSE DIPLOMA.—The letters D.F.H. are the official indication that the user is a possessor of the Diploma of Faraday House.

NORTHAMPTON POLYTECHNIC INSTITUTE.—A course of four lectures on "Industrial Applications of X-Rays" will be given at the Institute by Mr. G. Norman Kemp, B.Sc., during March. (See our advertisement pages to-day.)

Appointments Vacant.—Charge engineer, for the Wolverhampton Electrical Engineer's Department (Grade 8, Class F, N.J.B. Schedule). (See our advertisement pages to-day.)

Fatalities in Mines.—A preliminary statement issued by the Mines Department for the year 1923 (H.M. Stationery Office, price 4d. net) shows that in the mines and quarries of Great Britain there were 1,230 fatal accidents, causing 1,379 deaths, as compared with 1,081 accidents and 1,160 deaths in 1922. In coal mines, out of a total of 1,289 fatalities, 60 lives were lost due to explosions of firedamp or coal dust, and 12 are attributed to electricity—10 underground and two on the surface—as compared with a total of six in 1922 and one in 1921. In metalliferous mines and quarries there were no accidents due to electricity in 1923.

Travelling School for Engine Drivers.—As is well-known, Switzerland is gradually electrifying her Federal railways, which work naturally entails the adapting of the present *personnel* to future exigencies. The Chemins de Fer Fédéraux has no intention of dismissing the engine drivers and stokers who have been in its service for years; so, simultaneously with the electrification of the railroads, a travelling school for electrical training has been instituted for mechanicians. This "travelling school" consists of a large green railway coach, on which are painted the words "Wagon d'Instruction;" it is coupled to any train, and transported to the centre where instruction is to be given. It is divided into two compartments, admirably fitted-up, the first as a lecture-room, the other as a sort of museum.

In the lecture-room are a long table and a certain number of seats, a black-board, and a projection screen (for the carriage can be turned into a dark-room by means of light-proof shutters), ample apparatus are provided for explaining simple electrical phenomena, as well as an excellent diagram of the model of the tractor used on the Swiss railways, and a switchboard. Here lectures are given to the men, who show a keen interest in them, and who prove themselves capital students.

The second carriage, quite as well heated and ventilated as the first, is a never-ceasing source of interest: in it, duly classified, are to be seen apparatus for practical demonstration, magnets, electro-magnets, ammeters, voltmeters, models of dynamos, accumulators, &c., as well as examples of the evil-doings of short circuits and so on, and diagrams of all sorts of electrical accessories, and their arrangement on locomotives. The course of instruction comprises a programme of about forty lessons in theory and experiments, and about ten in engine management. The men are accompanied on a trial tractor by one of the engineers of the C. F. F., and "drive" under his direction a certain number of times. Then, when they give proof of their capability to run the locomotive on their own, they are entrusted with the entire responsibility for the train.

In the centre of Lausanne alone, about a hundred men are being instructed, with very satisfactory results, while other courses of instruction are being given, or have already been given, at other depôts. The locomotives actually studied are 1,800-h.p. (one-hour), 1,560-h.p. (continuous); they weigh 81 tons and their maximum speed is 90 km. per hour. It is hoped that the whole of the line from St. Maurice to Lausanne will shortly be run by electricity, which will mean that from the Vaudois capital to the other side of the Simplon, steam will have been done away with, as is already the case on the St. Gothard and Zurich sections.

The Transmission of Electrical Energy in Transitu.—The second general States' conference of communications and transit was held recently at Geneva, when two conventions were signed with regard to the international transit of electrical energy and the utilisation of hydraulic power. At the first conference, which was held at Barcelona, a resolution was passed expressing the opinion that it was desirable that the States possessing electrical energy in abundance should supply energy to those States which lacked it, and that the question should be referred to a committee for examination.

The commitee, reporting at the Geneva conference, stated that on investigating the question it was found that the problem could not be studied with advantage in the general terms set forth. Under these circumstances the subject was considered under two separate headings, namely, the transmission of electrical energy *in transitu* and the laying-out of hydraulic powers; both of these being of interest to the nations in general and capable of forming the subjects of international obligations.

As a result of the work of the committee, the conference at Geneva has led to the signing of two conventions. The first, to which representatives of twelve States appended their signatures, concerns the transmission *in transitu* of electrical energy, and it forms the first attempt at international regulation of the matter. The novelty of the problem and the absence of any international experience in this domain had the effect of raising great difficulties, which had to be overcome in order to reach an understanding acceptable to all States. Transmission *in transitu* necessitates the establishment of a high-pressure line on the territory of the country through which the energy is to be transmitted, a line which can serve no other purpose, and the transmission is not capable of being of direct and immediate advantage to the State granting the through right-of-way. Despite these circumstances, the conference succeeded in reaching an agreement preparing the way for future work. The convention only comprises obligations of a moral order destined to facilitate agreements between the States. Thus energy in transit is not to be subject to any special tax, but the State authorising the transmission over its territory is not to bear any costs, and technical solutions must not be influenced by any consideration of a political order.

The second convention, which was signed by representatives of eleven States, also opens a new field in the matter of international agreements. Its object is to develop arrangements between States for the utilisation of hydraulic power. Hitherto such arrangements have been entered into as between one State and another, which is said to have often rendered it very difficult to attain to an agreement.

In the first place, the second convention acknowledges the right of each State to carry out on its own territory works for the utilisation of hydraulic power, and it then deals with cases where the utilisation of such power involves an international study. A special article treats of the protection of the interests of States capable of being prejudiced through the utilisation of hydraulic power, although no obligatory procedure has been outlined for the settlement of differences, it being left to the States themselves to fix the procedure in each particular case by agreement.

The protocols of the two conventions remain open until the end of next October for the signature of any State represented at the conference, of any member of the League of Nations, and of any State to which the Council of the League of Nations has communicated for this purpose copies of the conventions.

At the conclusion of the second conference, the consultative and technical committee of communications and transit was reappointed. Among the countries represented on the committee are Great Britain, France, Italy, and Japan as permanent members of the Council of the League of Nations; and Austria, Belgium, Chile, China, Colombia, Cuba, Spain Greece, Norway, Poland, &c.

Electricity in Agriculture.—The Implements Committee of the Highland and Agricultural Society recently considered a letter from Mr. Andrew McDowall, Castle Douglas, containing a proposal that the Society should offer a monetary reward of, say, £5,000 for an effective method of reducing the cost of cultivation. Mr. McDowall has in view the utilisation of cheap electric power, produced by a central power station, for the operation of electric tractors for ploughing and otherwise cultivating the land. He is of opinion that by this method the cost of ploughing could be reduced by 50 per cent., and his proposal is that the suggested prizes should only be awarded on condition that such saving is demonstrated. Professor Stanfield, the Society's engineer, pointed out the practical difficulties involved in the proposal, and the Committee decided to defer arriving at a final decision.

Roaring Telegraph Wires.—The peculiar roaring sounds which may be heard in telegraph wires before changes in the weather take place have attracted the attention, during the past summer, of M. Nodon, chairman of the Société Astronomique de Bordeaux, France. The results of his investigations are that they are the effects of the attraction and vibration of the wires occasioned by electrified atmospheric masses, indicating, in France, the approach of storms from the north to the south or of squalls from the ocean when from west to the east. These facts, he considers, are of interest in forecasting changes of weather, and he suggests the installing of aerial conductor lines in suitable observatories planned according to the two principal directions, with amplifying microphones at the tops of the posts in contact with the conductor wires, allowing the directing of the roarings produced by the vibration of the wires into the observatory, where they will be discriminated and registered. Warnings obtained in this way, he considers, will be particularly serviceable to the fishing and other marine services in localities subjected to sudden squalls, such as, for instance, the bottom of the Gulf of Gascogne.

Institution Notes.

Radio Society of Great Britain.—ANNUAL CONFERENCE OF AFFILIATED SOCIETIES.—The annual conference of the affiliated societies of the Radio Society will be held at 2 p.m. on March 1st, at the Institution of Electrical Engineers.

Institution of Engineers (India).—SOUTH INDIAN ASSOCIATION.—The inaugural meeting of the South Indian Association of the Institution of Engineers (India) was held last December in Madras, when a large company was present, under the chairmanship of the Hon. Mr. A. P. Patro. Mr. Cartwright moved that the South Indian Association of the Institute of Engineers (India) be formed. Mr. J. W. Madeley seconded, and the proposition was carried. Mr. Ramalinga Iyer then delivered the inaugural address. He referred to the attempts made for forming an association by Sir Thomas Holland, Sir Claude Hill, and others. The chairman then declared the Association duly formed. In Great Britain and America, he said, there were institutes for special branches of engineering work, but in the Institution of Engineers in India were combined all those special features.—*Indian and Eastern Engineer.*

South Wales Institute of Engineers.—For his inaugural address before the Institute at Cardiff, on January 24th, Mr. W. A. Chamen, engineer and manager of the South Wales Electrical Power Distribution Co., the incoming president, took as his theme the recognition and adoption of Christian principles in the conduct of industrial affairs. His experience as a member of the District Joint Industrial Council and of the National Joint Industrial Council (Electricity Supply) for the past three years had made him, he said, a wiser man. The annual dinner was held at the Royal Hotel, Cardiff, on the same evening.

Institute of Marine Engineers.—The annual conversazione, which was to have been held on February 1st, has been postponed until March 21st.

American Institute of Electrical Engineers.—Last week the American Institute celebrated the fortieth anniversary of its formation. The annual meeting was held at Philadelphia, from February 4th to 8th. On the first evening the career of the Institute was to be reviewed by pioneers such as Messrs. E. Sperry, Elihu Thomson, T. C. Martin, and J. J. Carty, and the Edison Medal was to be presented to Mr. J. W. Lieb. There were to be nine technical sessions, at which over 40 papers were to be discussed, covering a wide range of subjects.

Institution of Electrical Engineers.—INFORMAL MEETING.—At the informal meeting, on February 4th, Mr. A. F. Harmer was in the chair, when Mr. F. W. Crawter opened a discussion on storage battery troubles, with the aid of a number of lantern slides showing types of cells and the construction of the plates in various stages. He claimed that the average engineer and battery owner had a mechanical rather than a chemical view of his battery, and the troubles were mainly due to mishandling. He urged that expert advice be taken directly unusual symptoms occurred. Mr. W. R. Rawlings expressed the opinion that a slower rate of charge seemed to ensure a longer life for the battery. Mr. J. W. Beck said that, if a battery be rated at 100, 99 per cent. of its utility would depend on treatment. In spite of the clearest directions from the makers, the mortality among batteries was very much greater than it should be. He knew of electricity works run on the most rigidly economical lines where the storage batteries were charged in the most extravagant manner, and had to undergo "forcible feeding." Mr. J. R. Bedford believed the G.P.O. reckoned the life of a telephone battery at about 150 cycles of charge and discharge. Mr. F. C. Raphael said that, broadly speaking, makers' instructions were not always consistent, and certainly not suitable for the conditions under which an ordinary house battery was installed. Messrs. W. R. Cooper, A. F. Harmer, A. G. Hilling, R. V. Hook, W. A. Ritchie, and F. A. Sclater also spoke, and Mr. Crawter summed up the discussion.

Institution of Heating and Ventilating Engineers.—The annual general meeting of the Institution of Heating and Ventilating Engineers was held at the Holborn Restaurant, London, on February 11th, when Mr. P. M. B. Grenville was made president for the year. In his presidential address he suggested that younger members should be included in the Council and on committees. Other suggestions for the future were the formation of provincial branches, and the institution of a bureau of information. He said the research committee had made very considerable progress in providing reliable data and he appealed for financial support to ensure that the investigations should continue without intermission. Sir George Croydon Marks, M.P., at a later stage delivered an address on the subject, "Inventions and Industries." He referred to the misconception in the popular mind as to what constituted invention as against what was described as discovery, and to the strange confusion of ideas regarding the protection of inventions by Letters Patent. He said that "discovery" might be defined as the bringing to light of what was already existent, but concealed or hidden from view, and therefore unappreciated by the ordinary observer, not the bringing into existence of something which, but for the investigator's discovery, would never have existed; thus Newton, Harvey, Faraday, and others did not invent, but discovered. On the other hand, "invention" was concerned with originating or producing something which did not previously exist, or doing in an improved way something which had previously been done otherwise. Thus Bessemer invented the process by means of which sulphur was removed from steel, Watt invented something which permitted steam to be economically used in an engine; and Edison invented a filament, which, under the influence of an electric current and when enclosed in a vacuum chamber, or globe, emitted light. The speaker then referred to the misapprehension in the popular mind as to the reason for the grant of a patent by the State, and said that what the State sought was the development of new industries, or the improvement of its industrial resources, based upon that which the inventor had originated and produced; in other words, it was something in the nature of a bargain or contract between the State and the individual, by which the latter surrendered the prospective sole enjoyment of his invention for a State-protected limited period of monopoly. By this the State secured for the nation the free use of the invention at the end of the patent period, and gave the nation the benefit of the improvement, or the new industry, which, but for the inventor, would not have had existence. Finally, the speaker warned his hearers against the astounding and revolutionary proposal lately before the League of Nations, relating to inventions, which, if proceeded with, would have a disastrous effect on industries depending on the development of scientific knowledge, as it proposed protection for the lifetime of the inventor and 50 years afterwards.

Junior Institution of Engineers.—On February 1st Mr. J. Ward, B.Sc., M.I.Mar.E., delivered a lecturette on "Torsion Meters," and described the principles of several makes. The Hopkinson-Thring is the one that is used in most of the ships of the Navy, and Messrs. Siemens Bros. & Co., Ltd., loaned one of the smaller sizes of this type for demonstration. The inventors of the various types of instruments were engineers who had a sound knowledge of the physical sciences, and although junior engineers were inclined to begrudge the time they had to spend at physics lectures and laboratories, the lecturer's advice to them was to grind in the principles thoroughly, and then the practical applications would easily follow.

On Friday last Mr. Kenneth Gray, F.S.I., M.R.San.I., delivered a lecturette on "Some Physiological Aspects of Heating and Ventilation." He said the usual form of estimate for the heating system of a large building provided for apparatus sufficient merely for maintaining a certain internal temperature with a given

outside temperature. Attention was focused almost entirely on this one quality—temperature. But the greatest degree of comfort was attained out of doors when the sun was shining and there was cool moving air; the temperature of the air was comparatively unimportant, but the other qualities which came into account were radiant heat and humidity. It was not easy to reproduce these out-of-doors conditions inside a building. Central heating was economical, but the distribution of heat by heated air fell very far short of the ideal. Radiators heated by water or steam tended to produce an atmosphere which was too dry, but they kept the fabric of the building warm, and with an efficient inside system of radiant heat the windows could be left open with impunity. This was certainly the case when the outside temperature was moderate, as in England, although in countries where the temperature fell to zero or below it might not be possible.

During the discussion Mr. Gray said he thought that the number of north lights used in factories was not always justified, because the advantage of extra good light was often outweighed by the big expense of suitable heating apparatus. Some improvement was now obtained by the use of double glazing.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

At the annual general meeting of the South African Institute of Electrical Engineers, held on January 17th, Mr. B. SANKEY, general manager of the Johannesburg municipal gas and electricity supply department, was formally installed as president of the Institute for the ensuing year.

The staff of the Portsmouth Corporation Tramways has presented a smoker's cabinet to the traffic superintendent, Mr. W. M. MUNFORD, to commemorate his 70th birthday and on completion of 50 years' tramway service, together with a rose bowl for Mrs. Munford.

Mr. A. E. EASTHOPE, works manager for Petters, Ltd., Yeovil, who is taking up an important position at Coventry with the British Thomson-Houston Co., Ltd., has been presented by his colleagues with a canteen of cutlery, and by the directors with a bookcase. His successor is Mr. E. P. Wrinch. Mr. Easthope was formerly on the staff of the British Thomson-Houston Co.

Mr. G. H. HUME, L.C.C., M.P., who has received the honour of knighthood, was chairman of the Highways Committee of the L.C.C. from 1914-1919, and has been chairman of the Electricity Committee since 1913.

Sir J. S. HARMOOD BANNER, M.P., who appears in the Resignation Honours List to receive a baronetcy, is vice-chairman of British Insulated and Helsby Cables, Ltd., and is on the boards of many well-known associated electrical undertakings.

On the occasion of his retirement from the chair of Electrical Engineering in the Royal Technical College, Glasgow, Professor MAGNUS MACLEAN was presented with a deposit receipt for a substantial amount and a silver salver with inscription, and his two daughters each received a turquoise-mounted toilet set. The presentation was made by Lord Blythswood, in the presence of a large company of prominent citizens. His Lordship said there were hundreds of men all over the world who had passed through Professor Maclean's hands, either at the University or the Technical College, and who acknowledged with pride that they owed much to his teaching. Dr. Maclean had been for 15 years assistant to Lord Kelvin at Glasgow University, and later he had been for 24 years the professor of electricity in the Royal Technical College. Professor Maclean, in reply, said that during the 40 years he had been teaching in Glasgow more progress had been made in the application of electricity to industrial purposes than was made in several centuries previously. He proceeded to trace the main outlines of electrical development as he had witnessed it.

MR. JAMES HUTTON, designer of internal combustion engines, has just joined Messrs. Vickers-Petters, Ltd., Ipswich, as their chief mechanical engineer. Mr. Hutton has had a wide experience in this branch of engineering, extending over about twenty-five years, with such firms as Vickers, Ltd., Crossley Bros., The British Westinghouse Co., Harland and Wolff, and prior to joining Vickers-Petters, Ltd., with the Keighley Gas and Oil Engine Co.

Obituary.—MR. GORDON LAYTON.—We regret to record the death of Mr. Gordon Layton, managing director of the Cosmos Lamp Works, at Brimsdown, of the Metropolitan-Vickers Electrical Co., Ltd. Prior to his joining that company, in 1899, Mr. Layton was manager of a company which interested itself in the running of a service of electric cabs in London. In 1899 he was specially sent to America by the British Westinghouse Co., with a number of other men, to study and familiarise himself with the American Westinghouse Co.'s methods of production. They were popularly known as the "Holy Forty." Mr. Layton returned to Manchester about the end of October, 1902, and took up work in the company's correspondence department, of which latterly he became chief. He was then transferred to the sales department, and was appointed later on manager of the Manchester district office, which position he held for many years. Subsequently he returned to the works, and became manager of district offices under the general sales manager, then Mr. Blunt. After some time, Mr. Layton paid a short visit to South Africa on the company's behalf, and shortly after his return to this country became manager of its "Cosmos" Lamp Works at Brimsdown, and finally managing director, the position he held when he died. He leaves a widow and three children. Mr. Layton was largely interested in promoting the Engineers' Club in Manchester, and subsequently the London Engineers' Club; he wrote the letter signed "M.I.E.E." in our issue of December 3rd, 1920, which set the latter scheme in motion. The funeral took place on Tuesday, February 5th, at Islington. Sir Philip Nash, chairman of the Metropolitan-Vickers Co., Colonel Cradock, and the managing director, Captain Hilton, were present.

MR. H. BOOTH.—The death occurred, at Whitehill, Wrotham, Kent, on February 1st, of Mr. Henry Booth, who had for 20 years been on the staff of the Westminster Electric Supply Corporation, Ltd. He was 71 years of age.

MR. EDWARD DEAN.—We learn with regret of the death, on January 25th, of Mr. Edward Dean, who, for the past 18 years, was general superintendent of the Century Electric Co., of Saint Louis, Mich. He was struck by a motor-cycle and died a few hours later. Mr. Dean, who was 57 years of age, was a native of Michigan.

MR. W. G. L. RIDDLE.—We regret to learn of the death of Mr. W. G. L. Riddle, a past-president and honorary life member of the Birmingham and District Electric Club.

New Companies Registered.

Auto-Electrics, Ltd. (195,452). — Private company. Registered February 1st. Capital, £2,000 in £1 shares. To acquire the business carried on at 65, Green Lane, Old Swan, Liverpool, by A. Hewlett and H. B. Ward, as "Hewlett's Motor Instruments Co.," and to carry on the business of manufacturers and repairers of, and dealers in auto-car accessories, including electrical testing instruments, &c. The subscribers (each with one share) are:—A. Hewlett, Spring Cottage, Green Lane, Stoneycroft, Liverpool, instrument maker; H. B. Ward, "Rock Hey," Victoria Park, Wavertree, Liverpool, instrument maker; F. E. Golding, 53, Litherland Park, Liverpool, instrument maker. The first directors are not named. Secretary: J. H. P. Cragg. Registered office: 30, The Arcade, Lord Street, Liverpool.

Flexible Lamps, Ltd. (195,431).—Private company. Registered January 31st. Capital, £5,000 in £1 shares. To acquire from A. A. Sandbrook the benefit of certain existing inventions relating to electric lamps for road vehicles, &c. The first directors are:—J. J. Brocklebank, Upper Terrace Lodge, Hampstead, N.W.3, director of Brooks (Motors), Ltd.; A. A. Sandbrook, 22, Cochrane Street, St. John's Wood, N.W.8; C. G. Brocklebank, The Manor, Davies Street, W. Qualification, £100 shares. Registered office: 99, Wigmore Street, W.

The E.L.P. Syndicate, Ltd. (194,442).—Registered as a private company on January 31st, with a nominal capital of £2,000 in 1,700 7 per cent. cumulative preference shares of £1 each and 6,000 ordinary shares of 1s. each. Objects:—To carry on business as a hydro-electric, electric, hydraulic, and other power supply company, and that of railway and tramway proprietors, financiers, concessionaires, &c. The subscribers (each with one share) are:—H. A. Crowe, "Aysgarth," Worple Road, Wimbledon, S.W.20, solicitor's articled clerk; Miss W. M. Coffey, 41, Melrose Avenue, Wimbledon Park, S.W.19, clerk. Messrs. Crompton & Co., Ltd., may appoint two directors so long as the agreement between this company and Crompton and Co., Ltd. (a draft of which is set out in the schedules to an agreement between Crompton & Co., Ltd., and the Melford Industrial Corporation, Ltd.), continues in operation, but as soon as the agreement is determined, the two directors so appointed shall cease to hold office. Two others directors shall be appointed by the Melford Industrial Corporation, Ltd., and upon the said agreement ceasing to operate, and the directors appointed by Crompton and Co., Ltd., relinquishing office, the ordinary shareholders shall thereupon be entitled to appoint two directors. During the operation of the said agreement, the chairman shall be appointed from time to time by the four directors so appointed from outside their own number. The chairman shall not have a second or casting vote. If the said four directors fail to agree upon a chairman, the names put forward by any of the four directors for the office, and voted upon by the Board, shall be submitted to the president for the time being of the Institution of Electrical Engineers, who shall make the appointment from among the names so submitted to him. Remuneration £100 each per annum. Secretary: T. W. Davies. The registered office is at Salisbury House, London Wall, E.C.

Parsons & Co. (Hove), Ltd. (195,523).—Private company. Registered February 4th. Capital, £6,000 in £1 shares. To take over the business of wholesale and retail ironmongers and builders' merchants carried on by J. Parsons & Sons at 124, Church Road, Hove, and to carry on the same and the business of dealers in electrical requirements, oils, colours, &c. The permanent directors are.—J. Drake, Greenhill, Rotherfield, Sussex, gent.; F. Parsons, 8, Pembroke Avenue, Hove, builder; H. W. Spenceley, 15, Brooker Street, Hove, ironmonger. Qualification, £100. Remuneration as fixed by the company. Secretary: H. W. Spenceley. Registered office: 124, Church Road, Hove.

Lentz Patents, Ltd. (195,468).—Registered as a private company on February 1st, with a nominal capital of £90,000 in £1 shares. Objects:—To carry on the business of civil, marine, electrical, mechanical, motor, and general engineers, brass, iron, and metal founders, brass finishers, metal workers, builders, public contractors, metallurgists, woodworkers, ship and boat builders, builders of locomotives, motor-cars, cycles, aeroplanes, &c.; to acquire certain letters patent, &c., relating to certain inventions with regard to transmission and other gears, &c., and to adopt an agreement with W. Dederich. The subscribers (each with one share) are:—A. J. Hull, 33, Gayaham Avenue, Ilford, law clerk; S. J. Sulston, 22, Deal Road, S.W.17, solicitor's clerk. The first directors are:—W. Dederich (chairman), no address given; H. Lentz, no address given; R. Freeman, no address given. The said W. Dederich may retain office so long as he shall live. So long as Davey, Paxman & Co., Ltd., and/or the Paxman Locomotive Valve Gear Co., Ltd., or their respective nominees, hold 8,000 shares, one of the directors for the time being shall be appointed by Davey, Paxman & Co., Ltd. Qualification (except nominee of Davey, Paxman & Co., Ltd.), 100 shares. Remuneration as fixed by the company. The registered office is at Imperial Buildings, Ludgate Circus, E.C.

G. R. Cooper (Oxford), Ltd. (195,410).—Private company. Registered January 30th. Capital, £16,000 in £1 shares (9,000 8 per cent. cumulative preference and 7,000 ordinary). To acquire the businesses carried on as G. R. Cooper in Oxford, and to carry on the business of ironmongers, sanitary, heating, and electrical engineers, metal workers, gas-fitters, house decorators, builders' merchants, oil and colourmen and Italian warehousemen, importers of, and wholesale and retail dealers in furniture, glass, leather goods, ironmongery, turnery, and other household fittings and utensils, china, crockery, metal and hardware, plate and plated goods; confectionery, groceries, provisions, drugs, chemicals, &c. The first directors are:—Mrs. Janet Cooper (permanent director and chairman), "Woodlands," Hinksey Hill, near Oxford; T. G. Hill, "The Nook," Foxcombe Hill, Berks. Registered office: 40-44, St. Ebbes, Oxford.

Electropeds, Ltd. (195,561).—Private company. Registered February 6th. Capital, £100 in £1 shares. To acquire an invention relating to an electro-medical appliance comprised in or covered by the British Patent Specification No. 1,715/1923. The subscribers (each with 20 shares) are:—R. A. Redmond, 58, Canning Road, Highbury, N.5, manufacturing confectioner; S. T. Williams, 36, Defoe Avenue, Kew Gardens, S.W., advertising agent. R. A. Redmond shall be permanent governing director as long as he holds £20 shares. Qualification, £5 shares.

J. S. Ramsbottom & Co., Ltd. (195,414).—Private company. Registered January 30th. Capital, £1,000 in £1 shares. To carry on the business of electricians, mechanical engineers and manufacturers, workers of, and dealers in electricity, wireless telegraphy, and apparatus for use in connection therewith, &c. The first directors are:—J. S. Ramsbottom, Devonshire Street, Keighley; H. Green, "Beech Mount," Cononley, near Keighley. Qualification, 100 shares. Secretary: J. S. Ramsbottom. Registered office: Bow Street, Keighley, Yorks.

Wireless Distributing Co., Ltd. (195,481).—Private company. Registered January 1st. Capital, £1,000 in £1 shares. To adopt an agreement with Mrs. M. Wainwright, H. Defries, M. Sellig, and S. Harrison, and to acquire the business of a buyer and seller of wireless requisites and similar goods carried on by Mrs. M. Wainwright at Walmer House, 282-292, Regent Street, W.1, as the "Wireless Distributing Co." The first directors are:—H. Defries, 17, Lingwood Road, Stamford Hill, N.; M. Sellig, 40, Kingswood Avenue, Brondesbury Park, N.W.; S. Harrison, 39, Kingswood Road, Brondesbury Park, N.W. Qualification, £5. Secretary: P. J. Pangbourne. Registered office: Walmer House North, 282-292, Regent Street, S.W.1.

Radieco, Ltd. (195,420).—Private company. Registered January 30th. Capital, £2,500 in £1 shares. To take over the business of a radio engineer carried on by F. A. Mayer at Wickford, Essex, as the "Radio Equipment Co.," together with the trade mark "Radieco." The first directors are:—F. A. Mayer, "Stilemans," Wickford, Essex, radio engineer; Mrs. B. E. Mayer, "Stilemans," Wickford, Essex; A. E. T. Catchpole, 9, Station Avenue, Wickford, Essex, radio engineer. Qualification, £100. Remuneration as fixed by the company. Registered office: Stileman's Works, High Street, Wickford.

Official Returns of Electrical Companies.

Parsons & Hodges, Ltd.—Mortgage on 63, The Parade, Leamington, with workshops at rear, dated January 16th, 1924, to secure £1,400. Holders: Mrs. E. Newey and A. H. Newey, both of North Street, Dudley.

Hayward's Heath and District Electric Supply Co., Ltd.—Deposit on January 18th, 1924, of deeds of land in Gordon Road, Hayward's Heath, to secure all moneys due or to become due from company to Barclay's Bank, Ltd.

Korland Manufacturing Co., Ltd.—Particulars filed of £200 debentures authorised January 11th, 1924, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Brisbane Electric Tramways Investment Co., Ltd.—Trust deed dated January 25th, 1924 (supplemental to deeds of 1900-1921), further postponing to January 1st, 1927, redemption of £45,000 debenture stocks, and continuing rate of interest at 8 per cent.

Tele-Dis Services (Founders' Company), Ltd.—Debenture dated January 10th, 1924, to secure £6,023, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Union Bank of Manchester, Ltd., 17, York Street, Manchester.

Falk, Stadelmann & Co., Ltd. (23,743).—Return dated January 4th, 1924. Capital, £650,000 in 365,000 preference and 285,000 ordinary shares of £1 each. 351,238 preference and 268,317 ordinary shares taken up. £248,816 paid on 185,800 preference and 63,016 ordinary shares. £370,739 considered as paid on the remainder. Mortgages and charges, nil.

City of Freetown (Sierra Leone) Electricity Co., Ltd. (138,058).—Return dated December 31st, 1923. Capital, £1,000 in £5 shares. All shares taken up. £1,000 paid. Mortgages and charges, nil.

Cutting Brothers, Ltd. (81,178).—Return dated December 28th, 1923. Capital, £40,000 in 3,000 ordinary and 1,000 preference shares of £10 each. 1,877 ordinary and 522 preference shares taken up. £10 per share called up on 1,477 ordinary and 522 preference and £2 per share on 400 ordinary shares. £20,790 paid. £3,200 considered as paid, being £8 per share on 400 shares. Mortgages and charges, £28,500.

Consolidated Signal Co., Ltd. (71,141).—Capital, £425,000 in 220,000 preference and 205,000 ordinary shares of £1 each. Return dated January 11th, 1924. 214,195 preference and 150,548 ordinary taken up. £52,839 paid in cash on 24,999 preference and 27,840 ordinary. £311,904 considered as paid on 189,196 preference and 122,708 ordinary. Mortgages and charges, nil.

City Notes.

Northampton Electric Light and Power Co., Ltd.

The directors' report, which is to be presented at to-day's annual meeting, states that the company's business continued to expand, although, owing to reduced prices, the receipts did not increase to the same extent as the consumption. The maximum demand rose by 9.8 per cent. to 5,248 kW, and the sales increased from 8,468,479 to 9,338,276 kWh. The revenue amounted to £105,013, and the working costs to £63,972, leaving a balance of £41,041. The following allocations have been made:—Depreciation fund, £17,312; reserve fund, £6,000; employés' benevolent fund, £1,000. The final dividend on the 5 per cent. preference shares amounts to £295, and a final dividend of 5 per cent. on the ordinary shares (making 9 per cent. for the year) is proposed. This will require £12,630, and a balance of £8,477 is carried forward. The holders of the seven per cent. second debenture stock have exchanged their holdings for new 5 per cent. stock; this arrangement becomes effective on July 1st next.

Rushden and District Electric Supply Co., Ltd.

The revenue account for the past year shows an income of £10,516, and expenses amounting to £7,542, leaving a gross balance of £2,974. It is proposed to allocate £2,075 to the depreciation fund, and to pay a final dividend of 4½ per cent. (making 8 per cent. for the year, as in 1922). This, with the dividend at the rate of 7 per cent. per annum payable on the 10,000 new shares, in accordance with the terms of issue, will amount to £1,236; there remains £2,811 to carry forward. The sales of energy increased from 569,601 to 671,096 kWh. Meeting to-day (Friday), at Northampton.

Allgemeine Elektricitats Gesellschaft.

The report of the directors of the A.E.G. of Berlin, which bears the date of January, 1924, has been issued for the financial year ended with June 30th, 1923, and the supplementary period of three months ended with the close of last September.

After referring to capital augmentations which were carried out during the period under review, the report states that the pause in business owing to the unfortunate monetary conditions was utilised for the purpose of effecting technical progress in the branches of production and distribution. The apparently favourable effect of the currency depreciation ceased with the second half of 1923, and the exchange difference as between German and foreign prices became more and more contracted. As a result of the occupation of the Ruhr the confidence of other countries in the capability of Germany to effect delivery was severely shaken. In the later periods the inland market stood under the influence of increasing scarcity of money. Nevertheless, the orders on hand rendered it possible to employ most of the workmen, and short time was carried out only to a comparatively small degree.

The demand experienced by the apparatus works was brisk, particularly for meters and typewriters; a new apparatus of much promise was brought out in the form of a flue gas tester, for which considerable orders had already been received. Concerning the Oberschonweide cable factory, the report states that the orders for the inland market declined as the electricity works had been obliged to restrict the extension of their networks. On the other hand, satisfactory activity prevailed in the matter of high-pressure cables for abroad. A further increase in the manufacturing programme of the locomotive works took place, both in regard to steam and electric locomotives, and new types of main line equipment were worked out and the manufacture begun. The heavy machine works was fully occupied during the year, and a good stock of orders was brought over into the new financial year; the small motor works, also, was active to the limit of its capacity. On the other hand, the tramway works had an insufficiency of orders, although some compensation was obtained from the demand for electric wagons. The development of the turbine department could be regarded as steady, and its activity in general was satisfactory, while a specially large demand had existed for transformers and switchgear.

Coming to consider associated interests, the report states that the Osram Company had maintained and strengthened its leading position in the international glow-lamp trade. In so far as Customs barriers rendered the export trade difficult, works had been established abroad under the company's control or with its participation. The Telefunken Company had great problems to consider, particularly on the other side of the ocean, and broadcasting had opened up a new sphere of activity. After references to the National Automobile Company and the Deutsche Werft of Hamburg, the report mentions that orders for large installations for the mining and iron and steel industries were scarcely obtainable after the stoppage of trade in the Rhineland.

The report proceeds to state that a further decline took place in the tramway business, the only large orders received being from abroad. On the other hand, main line trade developed favourably, and contracts were secured for the delivery of electric locomotives for Sweden, Norway, Java, and Portugal. Work on a number of locomotives was started for German account, including 33 for a Bavarian mountain line. Besides, in other directions, the report mentions that the company was devoting special attention to the utilisation of water powers, and a special department of engineers had been organised for the projecting and construction of such installations. Switching installations for hydro-electric works and transformer stations for pressures of up to 100,000 volts were in course of execution. Orders for high-pressure transmission lines were received to a large extent, and besides several sections for 100,000 volts, the company was constructing in the sphere of the Rhenish Westphalian Electricity Works a long-distance transmission line for a pressure of 220,000 volts, which pressure had not hitherto been used in Germany.

Since last July the report states that the company has arranged the calculations and charges on a gold basis. As previously announced, it is not proposed to make any distribution for the past year, the paper profits for which are returned at 104 billions of marks. Apart from the directors' report, a statement has been published of the probability of the company reducing the inflated paper share capital.

The "Underground" Group.

Declaration of the final dividends for 1923 have now been made by the "Underground" group of companies, as follows:

London Electric Railway Co.—Dividend of 2 per cent. on the ordinary shares, making 4 per cent. for the year, as in 1922. £65,000 is transferred to reserve, and £111,537 (as against £73,842) is carried forward.

City and South London Railway Co.—Dividend of 2 per cent. on the consolidated ordinary stock, making 4 per cent. for the year, the same as in the previous year. £36,000 is added to reserve, and £28,783 (as compared with £27,864) is carried forward.

Central London Railway Co.—Dividend of 2 per cent. on the undivided ordinary stock, the preferred ordinary stock, and the deferred ordinary stock, making 4 per cent. for the year in each case, as in 1922. £49,000 is allocated to reserve, and £94,728 is to be carried forward, as compared with £74,412 brought in.

Metropolitan District Railway Co.—Dividend of 2 per cent. on the ordinary stock, making 3½ per cent. for the year, as compared with 3 per cent. for 1922. £65,000 is transferred to reserve, leaving £84,088 (as against £77,075) to be carried forward.

Underground Electric Railways Co. of London, Ltd.—Subject to confirmation of the above dividends, and those of other companies in which the company is interested, the full half year's interest to December 31st, 1923, is to be paid on the 6 per cent. first cumulative income debenture stock, and 3 per cent., free of tax, on the 6 per cent. income bonds of 1948, making 6 per cent. for the year, as against 5 per cent. in 1922. A balance of £95,620 will be carried forward, as compared with £48,979 brought in.

Fife Tramway, Light and Power Co.

In his speech at the annual meeting, held at Edinburgh on February 8th, Mr. W. Low said there was little or no improvement in trade conditions during the year 1923, and in the absence of any material trade revival he thought that the trading results were satisfactory and justified the policy of careful development which had been adopted by the directors. There had been a satisfactory increase in the demand for supply for lighting and small power, and this department of the power and lighting business was being encouraged in every way possible. The conditions under which tramway undertakings were operating were still abnormal. Workers' traffic had not been resumed upon a regular basis, and the volume of pleasure travelling was restricted. These adverse circumstances, along with the increasing pressure of 'bus competition, had reflected upon the earnings of the tramway undertakings.

Yorkshire Electric Power Co.

The statement of accounts for the year 1923 shows that the net profit, after the payment of interest and debenture stock discount charges, was £130,055, as compared with £101,004 in 1922. To this was added £26,538 brought forward, making a total of £156,593. The directors recommend a dividend at the rate of 6 per cent. (of which 3 per cent. has already been paid) on the cumulative preference capital, amounting, less tax, to £38,283; a dividend at the rate of 8 per cent. (of which 3 per cent. has been paid) on the ordinary capital, amounting, less tax, to £58,669; the placing of £25,000 to the general reserve fund, making £154,000; and the carrying-forward of the balance (£34,640). The profit for the year showed an increase, due to larger output and more efficient production. The supply of electricity in bulk to authorised distributors continued to grow; in addition to the electricity supplied under existing agreements, supply was given during the year to the Urban District Councils of Ilkley, Newmill, and Skipton, and to the Electrical Distribution of Yorkshire, Ltd., for its Featherstone, Garforth, Horbury, Penistone, Rawdon, Selby, and Stanley undertakings. The supply to Skipton is being taken from the Keighley Corporation, pending the settlement of a scheme for the West Riding (Aire and Calder) Electricity District, and a supply was taken during the year from the Rotherham Corporation in connection with the company's developments in the southern area. As a result of the company's development, supply agreements have been made up to date with all distributing undertakings out of a total of 65 in the company's area. Important extensions have been carried out in the South Yorkshire coalfield, in the Colne Valley, in Wharfedale, from Otley to Ilkley, and from Airedale to Skipton. The company's stations are being extended to meet the growing demands. The new generating plant at the Darfield station is fully employed. The 12,000-kW turbo-alternator at Thornhill is in regular use, and the boiler-house extension is nearing completion. Orders have been placed for a further extension at the Thornhill station by the installation of another 12,000-kW turbo-alternator, which should be ready for service this year. A commencement has been made with the construction of the new capital station at Ferrybridge; this will ultimately become the company's principal station. An issue of 250,000 ordinary £1 shares at 23s. each was made in April last, and the whole amount has been paid up. The meeting is to be held in Leeds on February 19th.

Manila Electric Corporation.

The gross earnings during 1923 amounted to $3,571,881, as compared with $3,584,121 in 1922. Operating expenses at $1,821,155 were $118,201 less, leaving a gross balance of $1,750,726, $105,961 more than in the previous year. After deducting interest and other charges, and allocating $240,000 to replacements and renewals reserve (as against $108,000), a balance of $1,060,113 remained. The dividends on the common stock were at the same rate as in 1922, 8 per cent., but the increase in the amount of capital ranking for dividend increased the actual payment from $400,000 to $559,970.

South Metropolitan Electric Tramways and Lighting Co., Ltd.—Final dividend of 3 per cent. on the 6 per cent. cumulative preference shares, making 6 per cent. for the year. Dividend on the ordinary shares for 1923 of 5 per cent., compared with 7½ per cent. for 1922.

North Metropolitan Electric Power Supply Co.—Final dividend of 3 per cent. on the 6 per cent. cumulative preference shares, making 6 per cent. for the year, the same as for 1922. Final dividend of 4 per cent. on the 8 per cent. cumulative second preference stock, making 8 per cent. for the year; dividend on the ordinary shares of 10 per cent., the same as for 1922.

London & Suburban Traction Co., Ltd.—A dividend of 2½ per cent. on account of arrears on the 5 per cent. cumulative preference shares, as compared with 5 per cent. in 1922, is to be paid, subject to the confirmation of the dividends of the subsidiary companies. A sum of £9,715 is to be carried forward, as against £17,243 in 1922.

Traction and Power Securities Co., Ltd.—Negotiations have been concluded for the organisation of a British syndicate to take over the American holdings in the above company, which has long been controlled by American interests.—*Reuter* (New York).

Tyneside Tramways and Tramroads Co.—The report for the December, 1923, half-year shows that after meeting the preference dividend, 5 per cent. per annum, less tax, £500 is put to reserve and £503 carried forward. The traffic receipts decreased by £1,781, as compared with the corresponding half of 1922, and for the whole year by £3,494. Depressed industries on the Tyne and the boiler-makers' dispute are the causes.

City of Buenos Aires Tramways Co. (1904), Ltd.—The net revenue for the year 1923 amounted to £76,464 (against £76,198 for 1922). Of the receipts, the greater part consisted, as usual, of the annuity, amounting to £70,660, payable by the Anglo-Argentine Tramways Co. The dividend for the year is unchanged at 5 per cent., less tax, £5,000 is again transferred to general amortisation fund, and the balance of £9,464 is carried forward.—*Times.*

Kensington & Knightsbridge Electric Lighting Co., Ltd.—Balance dividend of 7s. per share for the half-year ended December, 1923, and a bonus of 2s. per share on the ordinary shares, making the total 14 per cent. for the year, as compared with 12 per cent. for 1922. As from the quarter ending Lady Day, 1924, there will be a reduction in the rates for lighting of ¼d. per unit, and a similar reduction in heating and power tariffs.

Bournemouth and Poole Electricity Supply Co., Ltd.—Final dividend on the ordinary shares of 6½ per cent., less tax, making 10 per cent. and a bonus of 3 per cent., free of tax. This compares with a total of 10 per cent. for 1922.

Clyde Valley Electrical Power Co.—Final dividend of 10s. per share, less tax, on the ordinary shares, making 8 per cent. for the year.

London Electric Supply Corporation, Ltd.—The directors announce a dividend of 6s. per share, 10 per cent., less tax, for the year, the same as for 1922.

W. T. Henley's Telegraph Works Co., Ltd.—Final dividend on the ordinary shares of 2s. per share, less income tax, making, with the interim dividend of 1s. per share paid on September 1st, 1923, 3s. per share for the year.

Liverpool Overhead Railway Co.—Half-yearly dividend to December, 1923, at the rate of 5 per cent. per annum, less tax, on the preference shares.

National Gas Engine Co., Ltd.—The *Financial Times* states that the board has decided to pay no dividend on the ordinary shares.

Stocks and Shares.

Monday Evening.

Electricity supply companies are answering the best expectations of those who knew that the industry was doing well, and that the shareholders would be rewarded this spring with a batch of excellent dividends. Following upon the 3 per cent. bonus declared by the Westminster Electric, bringing up the distribution to 15 per cent. for the year, the St. James' and Pall Mall also pays an extra 3 per cent., making 17½ per cent. for the year. The Bournemouth and Poole is another to pay a bonus of 3 per cent., making 13 per cent. for 1923. The Kensington and Knightsbridge, with a 14 per cent. dividend, shows a rise of 2 per cent. The London Company maintains its previously increased 10 per cent. The City companies had not announced their dividends when this was written, but optimism looked forward with pleasurable anticipation to the statements from these companies. The market in the shares is strong; last week's rises have been further improved upon in several cases.

St. James' shares are 25s. higher, Bromptons are 2s. up, Charing Cross 5s., Chelseas 3s. 9d., City Lights 3s. 3d., Metropolitans 1s. 3d. County ordinary remain at 2½, and South Londons at 39s. 3d. Londons went back to 5 on a slight disappointment with the dividend. There are a few Westminster ordinary obtainable at 11, at which the yield is over 6½ per cent. on the money, allowing for inclusion of the dividend and bonus in the price. Bournemouth and Poole are good at 43s.; the new shares at 4s. premium are relatively about a florin cheaper than their seniors.

The Tube Railways have declared their dividends, and the results are much the same as had been looked for in advance. The District is paying 3½ per cent. for the year. The Underground Electric Company again pays 3 per cent., tax-free, on its Income Bonds, making 6 per cent. for the past twelve months. Some people had rather hoped that there might be a small dividend on the company's £10 shares, but the directors decided otherwise, and the price of the shares is a little easier at 3½. The other issues of the company are also a trifle down, as is the case with District ordinary stock. This heaviness is due, of course, to the fear of a dockers' strike, which might involve the whole of the transport industry in yet another calamitous struggle. London General Omnibus ordinary stock gets a 9 per cent. tax-free dividend against 8 per cent. in 1922. The London Electric ordinary receives 4 per cent. again; the carry-forward of £111,300 is £37,500 up.

The London and Suburban Traction Company declares a dividend of 2½ per cent., 6d. per share, or half that of a year ago, and the reduction is put down in Stock Exchange circles to the competition of "pirate" 'buses and to other similar causes. The tramway companies do not appear to have done particularly well. With the forthcoming exhibition at Wembley this summer, and the consequent certainty that London will be extremely full of visitors, there should be ample scope for profitable working on all London lines, and the 1924 results for tramway and 'bus concerns should be considerably better than those of last year, which was, as the above figures demonstrate, a good one for the Tube railways.

Cable stocks and shares again went ahead, with rises in Eastern Extensions, Eastern ordinary, Globes and Westerns, though the advance was not maintained. For instance, Eastern Extensions, after touching 17½, went back to 17, and Eastern ordinary at 170½ is unaltered on the week after being a point or two higher. Marconis are depressed, the ordinary falling to 1 13/16, upon absence of any notification in regard to the interim dividend for 1923. That Marconi shareholders should be uneasy at the lack of information is natural enough. The price shows a fall of ¼ on the week. United River Plate Telephones have recovered from the effect of the new issue, and are again half-a-crown up at 6¼, the new shares, £2 10s. paid, being quoted at 4½. The American group is steady. Venezuelan Telephones are firmer at 12s. 6d.

Mexican Utilities are better, the Tramways Company's 5 per cent. bonds at 70½ showing a rise of 3 points. Brazilian Tractions continue to advance, and are 2 higher at 55½. Anglo-Argentine Tramways first preference rose to 3, but the second preference weakened to 2 11/16. British Columbia stocks continue to forge ahead, and are one or two points better on the week.

Manufacturing shares show up well. Encouraged by the excellent results reported by the Aron Meter Company, buyers have come in for General Electrics, Siemens and others of the same class. The movement spread to cable manufacturing shares. British Insulated have risen 3s., Callenders 2s. 6d., Telegraph Constructions 10s., and India-Rubbers 1s. 3d. Henleys are better at 50s., and British Aluminiums at 22s. Debenture stocks and preference shares hardened with the rest. Edison 5 per cent. debenture is up 3 to 75½. Midland Counties Electrics are fairly active. Several of the provincial shares have come into request, Llanelly and District ordinary amongst them, at 21s. 6d.

Engineering shares keep good. Babcock and Wilcox are better at 46s. 3d. Steady advances have occurred in the iron, steel and armament shares, the new Government's unemployed intentions being quoted as the reason for expecting better business in the North. All the banking chairmen have been admitting, if cautiously, an improved state of affairs in relation to the trade outlook, and a noticeable stiffening of money-rates is held to be due to expansion in trade as well as to the outpouring of new issues.

Share List of Electrical Companies

	Nom.	Dividend. 1921.	Dividend. 1922.	Price Feb. 11, 1923.	Rise or fall.	Yield p.c.
Home Electricity Companies.	£					
Brompton Ordinary	1	12	12	44/6	+4/6	£5 5 1
Charing Cross Ordinary	5	9	14½	14½	+ ½	5 0 0
do. do. do. 4½ Pref.	5	4½	4½	4½xd	—	5 9 0
Chelsea	1	6	10	38/9	+3/9	5 3 0
City of London	1	14	15	50/9	+3/3	5 14 6
do. do. 6 % Pref.	1	6	6	22/-	—	5 9 1
County of London	1	8	10	2½	—	4 14 1
do. do. 6 % Pref.	1	6	6	22/6	—	5 6 0
Edmundson's Ordinary	5	Nil	7	3½	—	5 13 0
do. 6 % Pref	5	12/-	6	4½	—	6 3 0
Kensington Ordinary		10	12	10½	—	5 14 3
London Electric	5	4	10	5	— ½	5 0 0
do. do. 6 % Pref.	5	6	6	5½	—	5 9 1
Metropolitan	1	7	9½	1/2	+ ½	4 9 6
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary	1	Nil	9½	16/3	—	9 1 0
do. 5 % Pref.	1	5	5	15/6	—	6 9 0
do. 7 % Pref.	1	7	7	22/6	—	6 4 5
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref.	1	6	6	22/-	—	5 9 1
Urban Ordinary	1	Nil	—	17/3	—	Nil
do. 6 % Pref.	1	3½	6	17/6	—	6 17 1
St. James' and Pall Mall	5	12	14½	13½	+1½	6 13 0
South London	1	7	10	39/3	—	5 2 0
South Metropolitan Pref.	1	7	7	24/6	—	5 14 3
Westminster Ordinary	5	10	12	10½	—	6 0 0
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	19/9	—	7 6 1
Home Rails.						
Central London Ord. Assented	Stock	4	4	71½	—	5 12 0
Metropolitan	,,	2½	3½	75½	—	5 6 3
do. District	,,	1	3	50½	+ ½	6 5 0
Underground Electric Ordinary	10	Nil	Nil	3½	+ ½	Nil
do. do. "A"	1	Nil	Nil	8/-	-6d.	Nil
do. do. Income	Bonds	4	5	102	-1	£5 18 4
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	103	+ ½	5 16 0
do. Def.	,,	1½	34/6	125½	—	6 13 4
Chile Telephone	5	6	6	5½	+ ⅛	5 5 6
Cuba Sub. Ord.	10	7	7	7½	—	9 13 3
Eastern Extension	10	10	10	17	—	5 17 6
Eastern Tel. Ord.	Stock	10	10	170½	—	5 17 6
Globe Tel. and T. Ord.	10	10	10	17½	—	5 16 0
do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel.	10	24	22	22½	—	7 16 0
Indo-European	25	10	7	23½	—	£7 7 8
Marconi	1	25	15	1½	— ½	8 5 0
Oriental Telephone Ord.	1	12	12	1⅝	—	£8 0 0
United R. Plate Tel.	5	8	8	6½	+ ½	£5 10 6
West India and Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	17	+ ½	£5 17 4
Home and Foreign Trams, &c.						
Anglo-Arg. Trams. First Pref.	5	5½	12½	3	+ ⅛	9 0 4
do. do. 2nd Pref.	5	Nil	5½	2½	— ½	10 5 0
do. do. 5% Deb.	Stock	5	5	74	—	6 15 0
British Electric Traction Ord.	,,	4½	5	68	—	7 7 0
do. do. 6% Pref.	,,	6	6	90½	—	6 1 10
Brazil Traction	100	Nil	4	55½	+2	7 4 0
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	58½	+2	8 18 0
do. do. Preferred	,,	5	9/6	58½	+1	£8 11 0
do. do. Deferred	,,	3	12/7	10½	+1	£8 3 0
do. do. Deb.	,,	4½	4½	80½	+1	5 6 0
Lond. & Sub. Trac. 5 % Pref.	1	3½	5	8/-	+9d.	11 6 6
London United Tram. Deb.	Stock	4	4	56	—	7 2 10
Mexico Trams. 5 % Bonds	—	Nil	Nil	70½	+3	7 1 10
do. 6 % Bonds	—	Nil	Nil	49½	+1	Nil
Mexican Light Common	100	Nil	Nil	18	—	Nil
do. Pref.	100	Nil	Nil	44½	—	Nil
do. 1st Bonds	—	Nil	5	62½	—	8 1 0
Manufacturing Companies.						
Babcock & Wilcox	1	15	20	2½	+ ⅛	£4 6 5
British Aluminium Ord.	1	10	5	22/-	+9d.	4 11 0
British Insulated Ord.	1	18	18	59/9	+3/-	5 14 6
Callenders	1	15	15	2⅞	+ ½	5 13 0
do. 6% Pref.	1	6½	6½	24/3	—	5 7 5
Crompton Ord.	1	10	5	½	—	10 0 0
Edison-Swan	4/-	10	Nil	4/6	—	6 13 4
do. do. 5% Deb.	Stock	5	5	75½	+3	6 13 0
Electric Construction	1	10	10	20/6	—	6 15 7
English Electric	1	5	5	17/6	—	5 14 3
do. do. Pref.	1	6	6	1	—	6 0 0
Gen. Elec. Pref.	1	6½	6½	22/6	—	5 15 7
do. Ord.	1	10	5	20/3	—	4 19 0
Henley	1	15	15	9½	+ ⅛	6 0 0
do. 4½ Pref.	5	4½	4½	4½	—	5 0 10
India-Rubber	1	10	—	⅜	+ ⅛	£5 13 4
Met.-Vickers Pref.	2	8	8	8½	—	6 5 0
Siemens Ord.	1	10	10	16/9	+1/-	Nil
Telegraph Con.	15	20	20	24	+ ½	£5 0 0

*Dividends paid free of Income Tax.

Practical Notes on the Reception of Very Short Waves.

By ALAN L. M. DOUGLAS, M.I.R.E.

PARTICULAR interest attaches to the use of very short wave-lengths for radio-telephone transmission at the present time, largely owing to the recent success of the British Broadcasting Co. in relaying short-wave transmissions from one of the more powerful American broadcasting stations.

There are a number of technical points in connection with the amplification of such short wavelengths which open up a valuable field for observations thereon, and I have some suggestions to put forward as to useful designs for suitable amplifier circuits in this article. The chief difficulty in the successful magnification of such wavelengths is to reduce or remove the small stray capacities existing between metallic conductors in ordinary receiving circuits so that the natural high frequency of the incoming signals will not suffer from parasitic couplings resulting in h.f. losses and frequently serious distortion. Probably the difficulty of greatest moment is the finding of suitable valves themselves which have sufficiently small metallic internal connections. The average inter-electrodal capacity of the ordinary "R" pattern of valve having four leads sealed through a glass pinch and fitted into a four-pin base may be as much as .00003 μ F. If a wavelength of 100 metres is being received, the effect of a grid-filament capacity of .00003 μ F on such a frequency (3,000,000 $\sim$ per second) can well be seen to offer a serious leakage path. When operating upon wavelengths of the order of 50 or 60 metres (likely to come into use more and more), it can be shown that something like 60 per cent. of the h.f. energy is lost, due to the presence of such a leakage path. Now, special designs of valves have been evolved to provide the advantages necessary for conserving the h.f. energy, the most successful of which is the Marconi V. 24 pattern. This is shown in fig. 1, from which the internal construction can be clearly seen, while the self-capacity is only about .000001 μ F. This is very low. It will be noticed that the grid and anode connections are made directly through the sides of the glass, and a special fitting is therefore necessary. This valve is very hard and will not rectify, hence it is extremely suitable for h.f. amplification. Its amplification factor is about 12, and, with a filament pressure of 4.5 V, anode voltage 65, and $-$ .2 V grid potential, its output is in the region of 2½ milliamperes. It is silent in use and not too sensitive to changes in grid potential.

We can, therefore, come to the conclusion that the V. 24 pattern of valve is necessary for short-wave amplification. It will now be proper to consider how inductances and transformers should be designed so that the minimum of h.f. damping takes place in the receiver.

H.f. current travels on the surface of a conductor rather than in it; it is therefore conducive to higher efficiency if any h.f. circuit is made up of a number of strands of insulated copper wire of small cross-section rather than a single stout conductor of, say, 16 s.w.g. The advantages attendant upon the use of wire having 36 to 80 strands of No. 36 or 40 s.w.g. d.s.c. copper conductor are: Conservation of h.f. energy; increase in signal strength; decrease in body capacity effect when operating apparatus; and a very remarkable increase in sharpness of tuning, resulting in the greatly-to-be-desired property of selectivity. It is important that coils so wound should be of as small physical dimensions as possible. This is to limit the extent of their electromagnetic and electrostatic fields, and is of especial importance when either an inductively-coupled aerial circuit is used or when reaction is effected on to the tuning inductance. The fields will be more intense if the coils are small, and not so subject to the influence of foreign bodies which may be included in them, thus giving greater control.

As an example, with a single-circuit tuner and a selective h.f. amplifier, using a well-known commercial pattern of interchangeable inductance wound with a single conductor first, and with a similar coil wound with 36/40 d.s.c. Litzendraht wire; with the first coil, 15 deg. movement of the aerial condenser was required to eliminate a short-wave broadcasting station near at hand. Signals were as strength 6 to the second figure; and a considerable degree of reaction had to be employed to counteract the damping losses in the oscillatory circuits.

With the second coil, 4 deg. movement completely eliminated the unwanted station; signals were of strength 9, as compared to figure 6 above; and no reaction whatever was introduced to give the same strength of reception as in the first case. These signal strengths were carefully observed with an audibility meter.

A word as to the design of high-frequency transformers for short wavelengths. The use of radio-frequency transformers is practically essential for multi-stage amplifiers; probably the capacitative coupling in

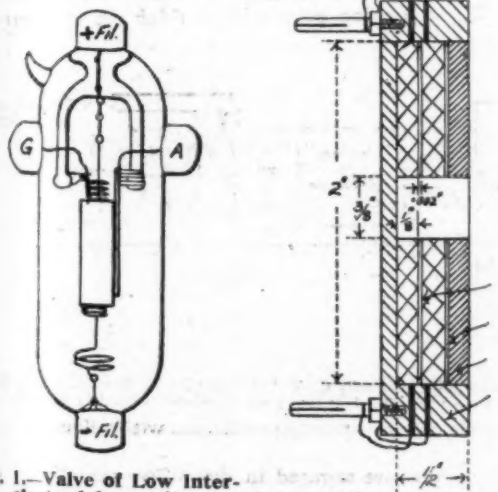


Fig. 1.—Valve of Low Inter-electrodal capacity.

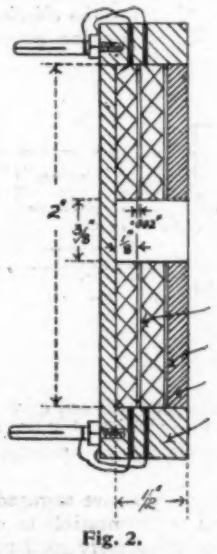


Fig. 2.

Fig. 2.—Design for high-frequency Transformer to operate on wavelengths of from 100 to 300 metres.

Wavelength.	Primary Coil (Untuned).	Primary Coil (Tuned).	Secondary Coil.
100	40	25	40
180	50	35	50
220	60	45	80
280	95	70	95
300	120	80	120

Gauge of wire for all coils No. 28 d.s.c.

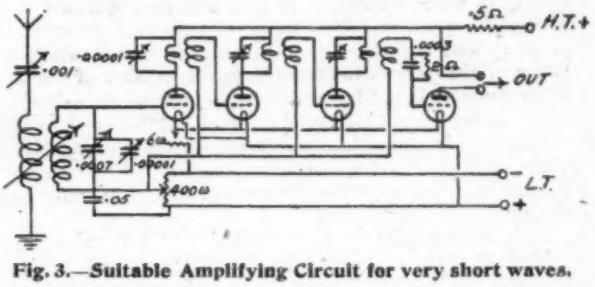


Fig. 3.—Suitable Amplifying Circuit for very short waves.

such an arrangement is much less than that in the "tuned-anode" system; at any rate, the transformer arrangement is capable of much more delicate grid potential control than the tuned-anode coupling, and is much more stable. It is not so important when designing the transformers to have the wire of a low h.f. resistance as to have the windings compactly arranged. If the gauge of wire used is small, *i.e.*, 36/44 d.s.c. wire, then there is a more satisfactory transference of h.f. energy by the capacitative coupling between the coils than would be the case if the coils had a low h.f. resistance and were distributed over a large area owing to the use of stranded wire.

In this connection it is interesting to note that the most satisfactory form for such transformers is the basket coil arrangement. The primary coil may be a very small basket closely coupled to another coil of similar physical dimensions which functions as the secondary. The ratio of windings is 1:1, no increase in amplification resulting from a step-up of turn-ratio. This bears out the observation that the coupling is practically entirely electrostatic as opposed to electromagnetic; but, nevertheless, there is some inductive effect, and it is a most important matter to arrange a compromise between the two which results in the maximum energy transfer. In multi-stage short-wave h.f. amplifiers it is often desirable to adjust the transformers to within narrow limits. This is best accomplished by means of a small variable condenser connected across the primary winding of each transformer, in which case the latter might have about two-thirds the number of turns otherwise required (the secondary remaining as before). This condenser should be very small—.0001 μ F as a maximum—because the greater the inductance relative to the capacity the greater the voltage variations across it, and in consequence the greater the energy transfer to the grid of the next valve.

It is most important that the grids of h.f. valves be held at the proper potential value with respect to the filaments. This is best adjusted by means of a potentiometer resistance connected as in fig. 3, which shows a typical short-wave amplifying receiver circuit. The apparatus can be made to oscillate readily by making the grids strongly negative, a feature which greatly assists in rapid searching for unknown stations. The filament temperature will, of course, to some extent also control the grid potential, and this must be borne in mind when noting adjustments.

Fig. 2 shows a good design of h.f. transformer which has been proved experimentally to be superior to any other for general short-wave working. Details of several windings are given. It is very important that careful attention be paid to the type of condenser used in high-frequency circuits. Where fixed condensers are employed, a mica dielectric is desirable, and condensers enclosed in metallic shields should never be employed except at low-potential points in the circuit (*e.g.*, across the h.p. battery, telephones, potentiometer, &c.).

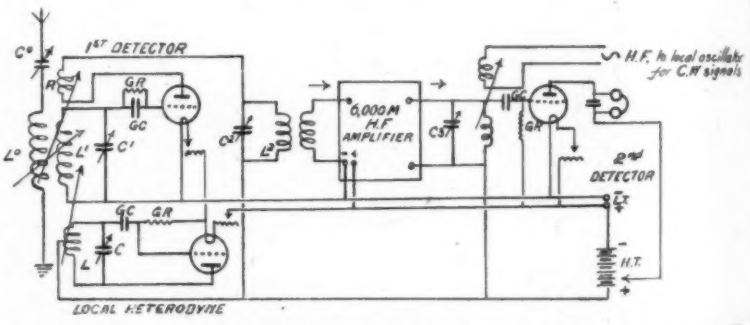
For variable condensers, an air dielectric is essential for sharp tuning, and insulating end-plates (paxolin, ebonite) should be insisted on. The minimum capacity effect in condensers having metallic end plates with an insulated central bush is regrettably high, and eddy currents are frequently set up which lead to serious troubles from body capacity effect.

A useful method of receiving very short waves is to employ the super-heterodyne apparatus, due to E. Armstrong. Owing to the difficulties already mentioned in connection with the amplification of extremely short waves, he has devised a circuit in which the natural high frequency of the incoming signal is changed to one of lower frequency and more suitable for amplifying by means of valves in cascade. This is accomplished by an application of the heterodyne principle, by adding to the signal another oscillation, whose frequency differs from that of the original signal frequency by an amount necessary to give a beat-note of the lower *radio* (high) frequency. This combination of currents is then rectified, and yields an alternating current whose frequency is equal to the difference of these frequencies.

If the plate circuit of the detector contains an L.C. branch tuned to the beat frequency, the higher-frequency currents will be suppressed, leaving the beat frequency current. Thus the system acts simply as a frequency transformer; and the output is of the proper wavelength to be efficiently dealt with by an ordinary h.f. valve amplifier.

I give a complete circuit for super-heterodyne reception of waves from 150 to 600 metres, with full details, in fig. 4. The use of the two detectors may confuse the reader, but it must be remembered that the first detector is used in the transformation of the frequency. The second detector is necessary, for the second frequency is still above audibility. It will readily be seen that this is a most suitable arrangement for the amplification of very short waves, as the intermediate amplifier frequency can be set at about 50,000 (a wavelength of 6,000 metres), which allows of easy and controllable cascading of valves to any required degree. Some energy is lost in the process of changing the frequency, but this can be easily compensated for by reaction at the lower frequency or by the use of an extra valve if desired. The local heterodyne is the important and controlling factor in the operation of this receiver, and critical adjustment of this is essential. Once, however, it is set, it need only be touched if any interfering signal arrives, when the slightest movement will eliminate any unwanted frequency. To change the initial frequency from 300 metres to 3,000 metres, it is only necessary to set the oscillator at 330 metres; hence it will be seen that the smallest alteration of the local frequency will make a great difference in the intermediate frequency, and therefore this is a very suitable receiver for the *elimination of unwanted frequencies*.

The foregoing notes will, I think, be of interest to many who are engaged in short-wave reception. It is not really possible to make a receiver so adaptable that it will amplify efficiently at all wavelengths from about 100 to 24,000 metres, but it is undoubtedly a good investment to build a high-frequency amplifier for short waves and another for long waves. At some future date the design of a complete short-wave amplifying receiver will possibly be considered, with which the writer has recently achieved some remarkable results.



C°, '0015 μF max.; L°, No. 50 and 25 Igranic coil; C¹, '0007 μF max.; L¹, No. 75 and 50 Ig.; R, No. 75 Ig.; L², two No. 250 Ig.; C², C³, '0005 μF max.; L, No. 50 Ig.; C, '001 μF max.; GC, '0002 μF; GR, 2 megohms.

Fig. 4.—Complete Super-heterodyne circuit, with valves.

Russian Orders.—Concerning the orders recently placed by Russia with English and Czecho-Slovakian firms for the delivery of central station plant, a German newspaper states that it is informed that owing to the extremely long credit granted in these cases the "co-operation" of the Germans in the matter can only be very restricted. Thus the orders for plant for the two stations amount to £600,000, of which only 15 per cent. has been paid as an instalment, while the balance, it is said, is to be paid off in seven years, the principal instalment being payable in the sixth year.

Some Researches on the Safe Use of Electricity in Coal Mines.

By Prof. W. M. THORNTON, O.B.E., D.Sc., D.Eng., M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

(*Continued from page* 233.)

A recent examination of the influence of frequency up to 500 periods shows the complex nature of the physical changes in the act of ignition. Fig. 7 is for pure methane in a 9.5 per cent. mixture ignited by the break of a non-inductive circuit maintained at 200 volts.

The first point to be observed is the high values of the currents necessary. There is an apparent time-constant, and the critical constant is a frequency of about 110. What is there about an arc that can have such a critical time-relation? A transient a.c. arc differs only from a d.c. arc in that each pole is alternately heated and cooled as the current rises and falls. Since the maintenance of an arc depends in the first place upon the stream of electrons from the cathode, such a relation must mean that when the frequency reaches a critical value the poles remain hot enough to give a continuous thermionic discharge while the current falls to zero, facilitating the activation of the gas in contact with the poles and improving ignition. For it is clear that ignition is relatively easier at high frequencies in the sense that the rate of rise is then less. If the early rate had been maintained it would have been impossible to ignite firedamp at a frequency of 500 except by the break of circuit of a machine of some 250 kW working at full load on unity power factor. There is at a frequency of 165 p.p.s. in the case of methane, but rather higher in coal gas, a most singular increase in ease of ignition. This is not maintained, for at a frequency approaching 400 the curve reverts to its earlier type.

The heating of the cathode or negative pole is greatest when the current is unidirectional, and the smallest igniting currents are therefore found in that case. As the frequency is raised, the difficulty of striking an arc increases on account of the delay in making a hot spot from which thermionic emission can take place. Now it is found that at the 200 volts used, and with the relatively small currents, there is never any "overshoot." Wherever in a half cycle the current is broken, it falls to zero and stops. During this fall the fresh gas mixture rushes into the space occupied by the arc, and ignition can occur if it is long enough in contact with arc and hot metal to be activated. The higher the frequency the shorter the duration of contact, and therefore the higher the current necessary to obtain the result in the time. At some frequency the pole will continue to glow and give off electrons after the arc is extinguished for so long that ignition can occur even though the arc itself does not last long enough for that purpose. In addition, if ignition is ionic rather than thermal—as everything indicates—the more rapid removal of the arc may make ignition easier by bringing the gas more quickly into contact with a hot surface still emitting electrons. There can be no doubt that the rate of liberation of electrons from the cathode in the air is much greater than that from the surface of the arc itself, for if the latter were greater the arc in air would expand in volume, like an explosion, by continually enlarging its conducting path. At still higher frequencies the heat given to the pole while the arc lasts is insufficient to raise more than a minute part of the surface to emission temperature. Heat is conducted from this so quickly that hot-spot ignition can no longer occur. There are few phenomena more striking than the suddenness with which thermionic emission ceases when there is a small drop of temperature from a critical value, and the reversion of the curve of fig. 7 to the original type at a frequency of about 380 is an illustration of this.

Ignition is electrical rather than thermal, and the first step is the formation of active oxygen ions. The conclusion to be drawn is that alternating current is always safer than direct current when there is little inductance, but that with the voltages and currents in use there is no real security for power circuits of either kind, except by complete enclosure. The currents in lighting and signalling circuits can, however, be kept well within the limits of safety so far as a break is concerned, and ignition by the hot filament of a lamp, always so difficult in methane, can also be prevented by some device which breaks the circuit when the lamp is cracked.

The results just described provide a means of improving the lighting of coal mines, and at the same time increasing the safety of working. At a frequency of 150 p.p.s. the least current for ignition from a lighting circuit is 23.5 amperes at 200 volts. The least direct current at this voltage is 0.4 ampere. The ratio of 60 to 1 should commend a.c. to those who desire "safety first" in lighting. But there is no necessity to run lighting leads at this voltage, a voltage of 25 being permitted everywhere. When we come to examine the currents necessary to ignite firedamp from such low-voltage circuits, the results of fig. 8 are obtained. At 160 periods and 15 volts not less than 175 amperes would fire the most explosive mixtures (10 per cent. of firedamp) when broken in it. Lighting and signalling might be operated from the same circuit if desired and, with the requisite protective gear to keep the maximum current in the case of a combined short-circuit and break to less than 175 amperes, immunity as complete as possible, apart from the human element, is obtained. The inclusion of a resistance of 0.16 ohm, or of a choking coil of similar reactance, would secure this, though the less inductance the better so far as ignition is concerned. Since there is no risk of shock at this voltage there is no reason why enclosed replaceable fuses should not be used in each lamp fitting and feeder.

In order to improve lighting at the working face it is necessary to devise a flexible and safe means of making contact. The following arrangement was devised for this purpose. Each portable lamp is fitted with a plug in its base so that it can be connected in the usual way to a socket of special design attached by flexible "cab-tire" leads to the 25-volt supply or to the power circuit through a transformer. The battery of the portable lamp of this type is smaller than in present lamps, for it has only to supply energy sufficient to give light when travelling to and from the working place. The double-filament lamp is pressed into the socket in which there is a safety interlock, and

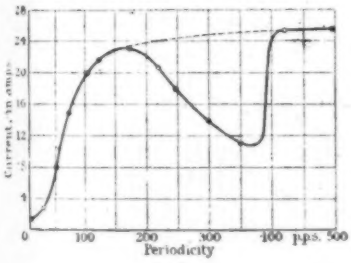


FIG. 7.

Fig. 7.—Influence of Higher Frequencies on Ignition of Methane. Transient Arcs at 200 Volts.

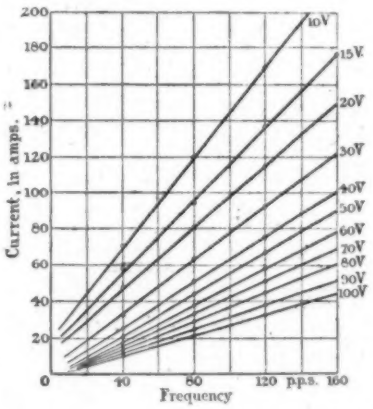


FIG. 8.

Fig. 8.—Ignition of Methane by Low-voltage Transient Arcs at Various Frequencies.

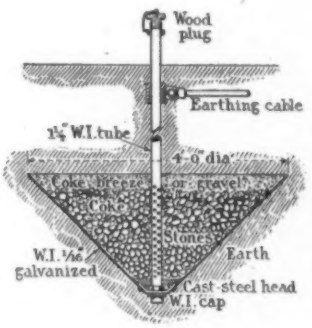


FIG. 9.

Fig. 9.—Earthing Plate.

the contact is then switched over from the 2-volt to the 15- or 25-volt filament. The increase in illumination obtained by this will be evident, but it is doubtful whether so great an increase is desirable, or desired by the miner himself. If it is an economic proposition to increase the lighting at the coal face to ten times its present amount, then here is a means of doing it with a factor of safety greater than that of present practice. The current taken by each lamp would be about 1 ampere, which, at 15 volts, is only 0.6 per cent. of the clean break igniting current. By the use of these higher-frequency currents and lamps with both internal and external cut-outs it is possible to give better illumination with greater safety than is even now possible.

Regarding the risk from oscillations on cable sheaths, and sparking to earth at points of high potential, electrical oscillations on the conductors within an insulated lead sheath due to switching or surges do not give rise to high-voltage oscillations on the sheath, nor any sparking at the ends where the potential rise might be expected to be greatest. In the case of cable armouring it may be possible to obtain minute sparks. There is, however, a real danger in the case of an unenclosed circuit in which there is heavy inductance, a voltage transformer for example. A surge on such a system reaching a coil has been know to give rise to a spark to adjacent conductors by which gas might be fired, and in one case such a surge has been suspected of causing an explosion in the cubicle of an oil switch underground. The gases given off by heavy switching are a mixture of hydrogen and methane, the products of dissociation of the oil by the arc. The presence of hydrogen extends the range of inflammability of "switch gas" and air, for it alone is inflammable in mixtures from 6 to 72 per cent. For the safety of coal mining two things are necessary: (i) The space above the oil must be thoroughly ventilated so that the gas is conveyed clear of the cubicle, and the switch so constructed that even if the enclosed gas is ignited no flame can emerge; and (ii) all live conductors should be enclosed so that there is a continuous bond between the armouring and the switch-box metal. To prevent the possibility of a surge spark through air the space must be filled with compound.

For everything except haulages in which fine speed-control is necessary, alternating current is preferred to direct current. From the point of view of incidental safety the advantage is with alternating current, not only on account of the lower risks of ignition previously discussed, but also on account of the relative freedom from faults. It is impossible in a mine to avoid having cables in contact with moisture in some place or another, and d.c. systems are often subject to trouble in damp places. There is a mechanical pressure of electrical endosmose by which an incipient fault is always augmented, the Hebburn case, in which the number of small cable faults was reduced from 164 to 1 in 6 years, by changing over from direct to alternating current, being the most remarkable example of the above effect, and of the further valuable fact that a faulty cable dries itself out when the supply is alternating.

Since coal is a very good insulator, a leakage to earth on an underground network cannot as a rule return to the earth plate at the surface without the risk of a large potential gradient somewhere underground. This is one reason why a continuous bonding of armouring to bank is specified in the special rules, in order to avoid shock by leakage. On the provision of an efficient earth the whole safety of electricity in mining depends. The essential feature of a good earth is to get the lines of leakage flow to diverge as quickly as possible from as large an area as possible, in order that the resistance may be small where the area of flow is small (see fig. 9).

Discussion at Liverpool.

Prof. W. M. Thornton, D.Sc., delivered his lecture at the Mersey and North Wales (Liverpool) Centre of the Institution on January 14th, and illustrated it with a number of lantern slides and very interesting experiments, showing how electricity could be used with safety in the working of the mines. His adaptation of electricity to make known the presence of dangerous gases in the "Davy" lamp was much appreciated by the members present. He also showed a slow-motion picture of a burning arc, which showed very clearly the passing of the alternating current through zero.

At the close of the lecture Mr. T. B. MORGAN asked whether one "earth" on the surface for the whole colliery undertaking would be more advantageous than a number of earths.

Mr. H. MIDGLEY asked whether any troubles in this country had been experienced due to static charges in the use of pulverised coal.

Mr. BOLTON SHAW thought that the curves were very interesting, but was of the opinion that it was difficult to take in the full force of their meaning.

Mr. H. E. DANCE raised some questions regarding the design of gastight motors. Mr. H. PRYCE-JONES referred to the temperatures of gasfilled lamps as compared with vacuum lamps, while Mr. J. A. MORTON asked the lecturer which he thought the better of two cables from the point of view of ignition—namely, a paper-covered lead and rubber-sheathed cable, or a bitumen cable with no lead sheath. The earth plate introduced by the lecturer he thought a very good type.

Questions were also raised by Mr. Spray, Mr. Malpas, and Mr. B. L. Mayer, the discussion being very curtailed due to Dr. Thornton's express wish that the paper be taken as a lecture.

Prospects in the Argentine Republic.

MR. H. C. CHALKLEY, H.M. Commercial Secretary at Buenos Aires, gives a depressing account of the finances of Argentina in his recent report* on that country's economic condition.

The present administration came into a bad legacy of indebtedness. It is not to be blamed for the accumulation of past budget deficits, although it has already been criticised for some of the methods by which it has sought, since Mr. Chalkley's report was closed, to balance revenue and expenditure.

The Commercial Secretary says that for the year 1924 increased taxation, the necessity for drastic economy, and the issue of large foreign loans on onerous terms burden the country, and the longer the delay in treating the malady the more malignant it will become.

There is, however, another side to the picture, and Mr. Chalkley says that against the depressing magnitude of the problem can be placed, happily for Argentina, a capacity in production, wealth and commerce which is without question far in excess of the burden to be borne. Many countries, he points out, might well envy the untouched potential capacity and the perfectly sound currency which denote the ease with which Argentine public finances might be restored to a sound basis.

Favourable Factors.

In reviewing trade conditions, the report recalls that the prospects of some improvement noted a year ago materialised in 1923, but adds that the prospects of further improvements are not so promising. At the same time it may be noted that since the report was written the records of both commercial failures and customs receipts show a very healthy tendency. These later developments therefore lend weight to Mr. Chalkley's advice regarding the extension of credit. In his view the outlook justifies British exporters in continuing to extend credit to established and tried connections, especially where based on experience of the line of conduct adopted by the particular importing firm in the evasion of contracts which followed the collapse of prices in 1920, but calls for caution in credit trading with small and new concerns. Liberal credit to old and restricted credit to new firms fits present conditions. The factor of credit in trading with Argentina has not the importance it once had when the German bid for trade supremacy was in full blast before the war. Both the supply of credit by competitors and the demand for it by local traders are reduced. The importance of credit has been superseded by that of prices.

Mr. Chalkley shows an exceedingly sound knowledge of political economy when he discusses the Argentine Government's fiscal policy. Any recovery of Europe, he says, would lead to a higher demand and better prices for Argentine foodstuffs and raw materials—meat, cereals, dairy produce, wool, hides, quebracho, and numerous by-products—and, also, the resumption of manufacturing activity beyond the present partial output would reduce the cost of production and, therefore, selling prices of the manufactured goods which Argentina requires. In the case of trade between the United Kingdom and Argentina, these conditions are of direct and practical application, since the United Kingdom is the leading country supplying imports to Argentina, and also by far the largest consumer of Argentine products. Restriction of imports by excessive customs duties or other means diminishes employment in the United Kingdom, and therefore the consumption of Argentine foodstuffs, while, on the other hand, the more imports from the United Kingdom are increased, the greater will be the demand from the working classes and their families for Argentine meat and wheat.

Seeing that the principal exports from the United Kingdom to the Argentine are cotton and woollen goods and iron and steel products, which are not manufactured to any extent in the Republic, a reduction rather than the proposed increase

* H.M. Stationery Office or D.O.T. Price 2s. 0d.

of import duties, which will add to the already excessive cost of living, would be of more benefit to the country. Argentina is a free-trade country as regards transport, railway materials being admitted free, but not as regards clothing and housing.

Many Competitors.

On the subject of competition, Mr. Chalkley does not take a very cheerful view of Britain's chances. In addition to that of the United States, the nature of which can be gauged, there is the low-exchange "dumping" by countries with depreciated currencies, the extent and continuance of which is surrounded by uncertainty. Amongst local competition to be feared is that of the manufacturers of electrical fittings. On the other hand, the Argentine consumer still prefers imported, and especially British, wares—a preference that is fostered by the local custom of making up goods to pass as foreign. It is, therefore, recommended that well-known brands of British goods should be protected by trade-mark registration, be intelligently advertised, and full use be made of such terms as "Made in England."

The rivalry of Germany is, in the Commercial Secretary's view, likely to prove most menacing in every line which she produces, provided that she emerges from the present situation with her factory capacity intact, a new currency, a permanently lower standard of living for labour, and a cost of production lower than that of the United Kingdom without an effective taxation at least equal to the taxation borne by British industry. It may be remarked, however, that many observers hold the view that these provisos are not all likely to be fulfilled. Cost of production depends upon the price of raw material and of imported food, which, in turn, depends upon the external purchasing power of German currency. That at present is very low. Moreover, it seems at last probable that taxation will be materially increased in Germany. It appears that her trade in electrical material and appliances has not yet been recovered.

Railway Future.

It is disappointing, but scarcely surprising, to learn from the Commercial Secretary's report that there is not likely to be in the near future a renewal of the pre-war investment of British capital in railway extensions and other public utility enterprises in Argentina. It will be remembered that this operation invariably entailed the placing of large orders for British machinery and materials. For some years already the United Kingdom has almost left this market, due in the days of the war to the success of the United States, and later to the undercutting of Belgium and Brazil. Mr. Chalkley says that it appears probable that in some cases the Continental contracts were taken at prices which resulted in losses. He adds that further heavy orders are expected to be placed, and probably on a more accepted financial basis, in which the prospects of British firms obtaining a satisfactory share are more promising.

Radio Telegraphy and Telephony.

On the subject of the concession granted to Siemens, Schuckert, Ltd., representing the Telefunken Wireless Company of Berlin, for the construction of a high-power radio station at Monte Grande, near Lomas, in the province of Buenos Aires, the report points out that the authorised capital of the original company (10,000,000 pesos) was, in January, 1923, increased to 14,000,000 pesos paper, the issue being fully covered by the public and the four companies, as also was the simultaneous issue of 2,000,000 pesos of debentures. The number of towers of 210 metres height has been increased to 10, and the transmitting apparatus, except for some duplicate motors, is now installed. Trials with U.S.A. and Germany were commenced in September, and signals exchanged successfully. It was intended to open a deferred service in November, which will be converted to a full service after being thoroughly tested. The receiving apparatus at Villa Elisa (near La Plata) is not yet completed. It is proposed to have four receiving stations there, one for each of the circuits, American, English, French, and German. During the year a coast station at Buenos Aires (called Dársena Sud) was completed; this will handle mercantile and naval traffic. It is operated by the Ministry of Marine. The Argentine army uses Marconi portable field sets.

Within the last year, the report states, the Argentines have taken enthusiastically to radio-telephony, which is peculiarly suited to the country, with its great distances, flat surface, poor road communications, and few country newspapers. Broadcasting is at present in the hands of three concerns, from whose stations maximum ranges have been reached in all directions of about 2,000 kilometres, the extreme points being Rio de Janeiro, Magellan Straits, Talcahuano, and Lima. Radio material was not generally on the market until the middle of 1922, when a local company, the Radio Sud America, was formed with a capital of 500,000 pesos by the British Marconi, American Radio Corporation, French T.S.F., and German Telefunken groups. The company sells apparatus through distributing firms, but there are also small local factories and dealers who manufacture and import radio articles. Development is hindered by lack of any legislation to control transmission, which is gradually resulting in anarchy in the air. A committee was appointed in February, and it appears to incline towards a compromise between English and American legislation, but it has not yet drafted a project of law, and this project will undoubtedly take some time to pass into the Statute Book. It is unlikely that it will include a tax on receiving apparatus held by private individuals, but a broadcasting committee would probably be formed, and its revenue principally be derived from the taxation of radio manufacturers and dealers. There is an interesting project to install an inter-port and inter-farm radio-telephone subscribing service in Patagonia to supplement the State telegraph line, which is frequently broken down by gales and snowstorms.

Fused Silica in the Electrical Industry.

The paper on "The History, Development and Commercial Uses of Fused Silica," read by Sir Richard A. S. Paget, Bart., before the Royal Society of Arts on January 30th is of considerable interest to the electrical industry, in that not only is the use of fused silica finding more and more application in the industry, but electricity itself plays an all-important part in its production.

The author pointed out that silica is the commonest constituent of the earth's crust. It is estimated that of the first 10 miles depth, 60 per cent. consists of silica—occurring as quartz rock, sandstone, and other forms of silica—either free or combined with metals or metallic compounds. The form of pure silica from which all the highest grades of transparent fused silica are made is rock crystal. Next in order of utility for this purpose are the deposits in the form of small crystals, commercially known as geyserite, and, lastly, there is silica sand. For the manufacture of fused silica ware only the highest grades of sand are suitable, *i.e.*, with a silica content of about 99.8 per cent.

The earliest experiments referred to in the paper on the fusing of quartzite or silica were those carried out by Gaudin, of Paris, in 1839, using an oxy-hydrogen blowpipe. In 1878, Gautier exhibited small fused quartz tubes made with the blowpipe. In 1888, however, Sir Charles Parsons communicated to the Royal Society a series of experiments, including that of fusing silica sand by means of an electrically-heated carbon rod embedded in the sand, the fusion being carried out inside a closed cylinder and under a pressure of from 5 to 30 tons per sq. in. This is believed to be the first instance in the history of silica fusion of the use of a carbon resistance rod, a method which has since become the standard system of heating.

In 1889, Professor Vernon Boys devised his beautiful method of drawing very fine quartz threads by means of a miniature crossbow and arrow. Research work was continued by numerous investigators until 1902, when the fusion of pure silica sand was undertaken on a larger scale. In that year, in the United States, Elihu Thomson patented a method of forming articles of fused silica by a process similar to that of Sir Charles Parsons, but working at atmospheric pressure, and in this country R. H. Hutton, of Owen's College, Manchester, at the same time, independently developed a very similar process. Hutton formed silica tubes either by passing a current through a carbon rod embedded in sand, or by supporting sand in a graphite trough having a graphite core fixed axially within it, and fusing the sand round the core by an electric arc arranged to travel longitudinally immediately above the trough. Both Thomson's and Hutton's methods produced the same new material, *viz.*, a fused silica, of white, slightly translucent, appearance, but both processes suffered from the disadvantage that the size and shape of the fusion were limited to those of the heating core, and in these processes, as with some subsequent ones on the Continent, it was essential to keep the temperature as low as possible in order to avoid the reaction of silica and carbon.

In 1903, as the result of work carried out by the present Lord Rayleigh, experiments were started by the Thermal Syndicate (with which Lord Rayleigh is now associated) at Wallsend-on-Tyne with the object of developing, if possible, a commercial method of fusion by means of some form of electric furnace. After numerous failures, an accidental result pointed the way to success, and it was found that by working at a much higher temperature than Thomson and Hutton, and by carefully regulating the temperature, it was possible not merely to bring the whole fusion to a state of substantially uniform plasticity, but also so to regulate the interior

gaseous pressure—due to CO and silica vapour formation—that the fusion remained separated from the core except at the relatively cool extremities. There was, under these conditions, no further reaction between the silica and the carbon, and the fusion could be blown up, *in situ*, into moulds surrounding the fusion, or the core could be withdrawn altogether from the fusion and the fusion itself removed from the furnace. The fused mass, in the form of a large tubular sausage, was found to retain its plasticity for a considerable time, and, in consequence, could be drawn into tubes, or blown into moulds, or pressed or rolled, without reheating.

The material produced by drawing, blowing or pressing a sausage of fused silica sand, differed from the products of Thomson and Hutton, in that the spherical gas or air bubbles which were disseminated throughout the mass in the former processes, and which were responsible for the colour and opacity of the product, were in this case drawn or spread out into threads or laminations, so that the material had a grain. This resulted in the production of a lustre, which had a practical use in the case of electric and gas lighting bowls. It is interesting to note that the first important exhibition of vitreous silica ware was made by the Thermal Syndicate at the Brussels Exhibition of 1910. Sir Richard said he believed these were the only exhibits (except some made of platinum) that survived the disastrous fire which destroyed the British Section.

The paper then dealt with the physical properties of fused silica, such as its low coefficient of expansion, relatively high softening point, etc., as well as its mechanical and chemical properties, and it was pointed out that it was entirely unaffected by acids or mixtures of acids, except hydrofluoric and phosphoric acids.

As to its electrical properties, the most interesting is its low conductivity at high temperatures. Though, said the author, at ordinary atmospheric temperatures, porcelain is considerably the better insulator, at 150 deg. C., fused silica has 500 times the resistivity of porcelain. At higher temperatures, however, the resistivity falls. Fused silica has the further advantage over porcelain and glass, as an insulator, of being less hygroscopic, so that surface leakage is reduced. The specific inductive capacity is relatively low, being from 3.5 to 3.6, as compared with 5.6 for mica and porcelain. The dielectric strength of fused silica is equal to that of the best glass:—

	kV per cm.
Commercial insulating oil	50—100
Glass	75—200
Fused silica	100—200

Fused silica has been used successfully as a high-pressure insulator for direct current in Cotterell precipitation plant for the treatment of flue gases, under conditions of heavy arcing, which caused all other insulators to break down.

The optical properties of fused silica were also dealt with, and its greater transparency as compared with glass was demonstrated.

In U.S.A., the G.E.C. has in recent years carried on silica fusion at Lynn under Dr. Elihu Thomson, and a description of the products of these works is given in the *General Electric Review* for February of last year. The most interesting technical advance by the G.E.C. is in the production of transparent rods and tubes by drawing a fused mass of rock crystal between water-cooled dies. Besides transparent ware, the G.E.C. has produced 6 in. by 10 in. moulded insulators for h.p. work. It is curious, said Sir Richard Paget, that the writer of the G.E.C. article referred to—which gives an historical *résumé*—is apparently ignorant of all the work which has been done in Europe since 1902. The G.E.C., he said, is not usually 20 years behind the times.

Referring to the products of the Thermal Syndicate, he said that an interesting development was the manufacture of large thermionic valves for radio work. He exhibited two valves of Signal School design, manufactured by the Mullard Radio Valve Co., of Balham, the fused silica parts being supplied by the Thermal Syndicate. One was of 2.5 kW, and the other of 10 kW output. An envelope, measuring 32 in. by 8½ in., for a still larger valve, was also exhibited. This envelope had corrugations, for the purpose of resisting air pressure from outside.

Discussion.

Sir CHARLES PARSONS, F.R.S., said he had been astonished when he had read the G.E.C. journal, because he had always understood that the Thermal Syndicate had done a great deal of pioneer work. He suggested that 100 copies of the lecture should be sent to Dr. Elihu Thomson.

Professor VERNON BOYS, F.R.S., expressed surprise at the author's statement that at ordinary atmospheric temperatures porcelain was a better insulator than fused silica. From experiments which he had carried out, he felt almost inclined to question that statement.

Dr. R. H. HUTTON said he also had been astonished to read the article referred to in the *General Electric Review*. In 1902, he said, he read his first note on the fusion of quartz, in Manchester, and later in the same year he had read another paper on the subject in America. Whilst he was there it was mentioned to him that Dr. Elihu Thomson was working on fused quartz, and he had had an opportunity of seeing what was being done. At that time he kept a diary, and when he read the article last year he quoted to Dr. Elihu Thomson a few paragraphs from it. As a result, he received a long letter from Dr. Thomson, which was merely an appeal to him (Dr. Hutton) not to claim for himself the credit for the work which Dr. Thomson had done in those days. As a matter of fact, he (Dr. Hutton) complained only that Dr. Thomson had said that he had given him the idea of doing what, after all, was apparently done many years before by Sir Charles Parsons.

Mr. C. R. DARLING claimed to be one of the first to use silica tubes for small electrical resistance furnaces. He had used resistance furnaces with porcelain tubes, but had found that if he switched on a strong current suddenly they always cracked, and had almost continually to be renewed. The moment silica tubes were made he had procured one and had wound it, and, to his great delight, it had stood up almost indefinitely. One could almost switch on the full current straight away. Continuing, he said it would be a great advantage if those working with silica could find some kind of lining which would not be attacked by metallic oxide. He was not aware that very much had been done with zirconia on those lines, and would like to know whether there was any prospect of making zirconia tubes, because zirconia was not attacked by many metallic oxides.

Sir HERBERT JACKSON (the Chairman), said that he also would not accept at present the statement that any good porcelain was necessarily, in the cold, a better insulator than fused silica, and thought it quite possible that that statement could be reversed.

Sir RICHARD PAGET, in reply to this question as to the conductivity of silica, said the figures given in the paper were taken from the results obtained by the United States Bureau of Standards during the war in connection with their tests of various insulators for sparking plugs. He was very glad to hear that the position was so much better than he had been led to suppose. With regard to the possibilities of using zirconia, he said he had made casting experiments, but was afraid that the material was no good because it had a high coefficient of expansion, and cracked even on cooling of the casting, and it did not arrive at a stage of plasticity, as did silica. So far as his experience went, therefore, there was not much hope of using it as a casting material, although it might be used as an aggregate material, like silica bricks and that kind of thing.

Institutional Engineering.

IN the course of his presidential address to the Birmingham Electric Club, Mr. W. Shaw, M.I.E.E., pointed out that in the selection of plant for an institution, hospital, &c., economy was of much more importance than efficiency, and reliability of far greater importance than either. Engineers, in general, were apt to give so much thought to efficiencies that in some cases sight was lost of the real ultimate aim—high economy. The quantity of boiling water per head per day in an institution generally amounted to 20 gallons, and the laundry only accounted for five gallons per head per day. Electricity had practically superseded gas for lighting in most institutions. It must be confessed, however, that in some instances, especially in hospitals, the schemes adopted were not the most suitable for their purpose. Any material departure from nature's principles of illumination must sooner or later give trouble. Glare might occasion real distress to the sick; insufficient light was also injurious. Ward lighting could best be obtained by providing local shaded lights, each with its own switch for the patient, and general lights with low foot-candle illumination in the centre well diffused without glare, with provision for dimming the general lights at night. Local lights should also be provided for the sisters' and nurses' table.

Electric cooking was finding favour with the chefs and cooks, to the exclusion of gas and coal-heated ovens and ranges. Electric heating was "off the map," unless the institution had its own plant and wanted more heat than the exhaust from the engines could provide. While the first cost of an automatic telephone system was higher than that of a manually-operated switchboard system of the same size, owing to the fact that the services of operators were not required, the annual charges were less, particularly where a continuous service must be provided. With regard to maintenance, experience showed that an ordinary electrician was capable of doing the work if the makers' simple instructions were carefully carried out. In small institutions, gas and crude oil engines, especially where there was no laundry and very little domestic heating, could not be equalled, for fuel economy; 20 ft. of gas would at the best give 300 c.p. if burnt in incandescent burners, whereas an engine and dynamo would give 1,000 c.p. from the same amount of gas. Crude oil, at its present price, would give the same amount of power and light for half the cost of gas, but it should be installed with caution where gas was available, as it had a nasty habit of jumping in price.

For a hospital for 500 inmates and staff, including ranges, steaming oven, fish fryer, hot plate cupboards, special egg poachers, &c., 20-gallon soup boiler for stock pot, 20-gallon vegetable boilers, 20-gallon water boilers—the daily running costs would be less than ½d. per head per day. In cases

where institutions had their own electricity generating plant, electricity was usually not employed to the extent that it should be. Given a steam plant available, it would pay handsomely to work the engines up to power and to use electricity in place of gas fires, sterilisers, and roasting appliances in the institution, while the exhaust steam from the engines should be used for boiling in the kitchen and all laundry purposes, except the calender. Although steam was used in so many ways in an institution, there were only two points which needed steam at a pressure of more than 10 lb., *i.e.*, the calenders in the laundry and the disinfector, which should also be adjacent to the laundry and boilers. To exhaust steam from an engine at 5 or 10 lb. pressure would increase the steam consumption, but when the exhaust was used for the kitchen and laundry purposes instead of live steam, it did double duty, and so the loss in efficiency of the engine was immaterial. The ideal to aim for was to generate power to such an extent that there was exhaust steam enough for all kitchen, laundry, and heating requirements, and to make economical use of the power generated by turning it into electricity for lighting, cooking, and heating. The steam and electrical requirements must balance, or there would be loss. Consider an actual case:—Maximum demand for steam was: for laundry (1,000 lb.), kitchen (600 lb.), h.w.s. (2,000 lb.). heating (4,800 lb.), or 8,400 lb. per hour. This amount of steam would comfortably be given out from an engine of 210 kW. Maximum demand for electricity was: for light (45 kW), power (25 kW), X-rays, &c. (10 kW), sterilisers (4 kW). A maximum of 1,320 cu. ft. of gas was previously used per hour for cooking and heating. The electricity required to give the same British thermal units as the gas was 120 kW, a total of 204 kW. The maximum load in the kitchen for steam came on at the same period as the maximum load for roasting. Similarly in the laundry, the heat was required at the same time as the power, thus as the electrical load for roasting, &c., increased, so the amount of exhaust steam increased, and was available for the heavy boiling load in the kitchen and heavy laundry duty. By the adoption of this system, if the loads balanced accurately, the saving would be the difference between the present cost of lighting power, and gas for cooking, amounting to £3,000, less the increased consumption of steam, due to exhaust steam being used instead of live steam for boiling, heating, and hot water service, which would be £500. This would leave £2,500 to pay for interest, depreciation of plant, labour, and maintenance. The necessity for keeping systematic records and analysing the results at the end of each month could not be too strongly advocated. The amount of boiler fuel consumed in institutions, of which the author had the figures, varied from 2.6 to 13 tons per head per annum. In the first case the institution generated its own electricity for lighting, and in the second case purchased gas for lighting. The average present-day engineer was only too willing to keep records and take a keen interest in the results, if shown the right way and provided with the necessary facilities and apparatus for doing so.

A Non-Technical Explanation of Power Factor.—I.

Results of the Electrical Apparatus Co.'s Competition.

As has already been briefly announced there was a large number of entries for the competition instituted by the Electrical Apparatus Co., Ltd., for the best non-technical explanation of power factor. Mr. S. T. Allen, M.I.E.E., chief engineer and manager of the Wolverhampton Corporation electricity undertaking, who acted as adjudicator, found that many excellent explanations were too technical to merit the award of a prize; moreover, two of the best (which were, however, not submitted for competition) emanated from Mr. R. Amberton himself under *noms-de-plume*. The following are some of the essays:—

Mr. C. Turnbull.

It may be thought that the following explanation is too short, and that further elucidation by way of analogy would make things clearer. My reason for cutting it short is, first, that business men will not read long articles, and, secondly, that *they do not want to be convinced* that they should pay more for bad power factor.

They therefore read the explanations with a view to detecting some excuse for getting off the extra charge. Analogies unfortunately have the fatal habit of being suitable for being turned round to face the other way. Once a business man thinks he can use your argument against you, he repeats and repeats it, giving it as "Your own words"!

I suggest, therefore, that the statement should be short and to the point, and that it should make clear that low power factor *costs more to supply* and, therefore, must be charged at a higher rate.

Suggested Letter to a Consumer Whose Motors have a Low Power Factor.—You ask us to explain the reason for our charging you extra rates to cover the low power factor of your motors, and particularly to state clearly what is meant by the term "power factor."

The motors which you are using are—as one may express it—greedy: they take too much current at each mouthful and immediately afterwards spit the surplus back again into the supply mains. Consequently the mains have to be big enough to carry, not only the current which your motors actually use, but also the surplus, or idle current, which they first absorb and then return to the mains. In your case the mains have to be (40 per cent.) larger than would be necessary if your motors did not act in this manner.

This surplus current has to travel right back to the generating station, where it must be absorbed by the generators and then given out again: in fact, the idle current continually oscillates between the station and your motors. It does no useful work at all, but is a cause of loss both in the mains and in the generating plant.

The term "power factor" is used to indicate the tendency of motors, or other plant, to create idle current. Plant with a high power factor creates little idle current, while when the power factor becomes lower, the proportion of idle current increases. This naturally increases the cost of supply.

You will thus see that motors whose power factor is low, require larger and more expensive supply mains and more costly generating plant at the electricity works, while in addition to these items, coal is wasted in keeping idle current circulating. As our tariffs are based on the costs of supply, we must necessarily charge you for the idle current.

You may ask: Can this idle current be abolished? It can, either by the use of special motors, or by the installation of certain apparatus of which we will be glad to give you details. In fact you can take your choice, either to eliminate the idle current, or you can pay the cost of the supply of such.

Mr. Reg. H. Rawll.

The first essential in attempting to explain the mystery of p.f. to a non-technical power consumer is to open the conversation in such a manner that thereafter he will always visualise electricity as a material fluid. Once this view of the subject has been firmly instilled into his mind, the principal difficulty has been surmounted; but be quite sure *that he really has grasped this fact*, otherwise, in the writer's opinion, it is useless and a waste of time to continue the explanation. Having progressed so far successfully proceed along the following lines:

Power stations are erected to force or pump this fluid to the consumer's premises and, if the switches are "on," it will flow through the various connected appliances, giving up its energy in the form of mechanical power, heat, light, &c. After the electricity (as the fluid will now be called) has done its work, it returns to the power house, just as in hydraulic plant after the water has passed through the power presses, rams, &c., it flows back to the force pumps, where it is again sent out with renewed pressure. Now, in order to operate electrical plant in a distant factory a certain call for electricity is made on the power house and cables are laid along the roads to convey this current. But some electrical apparatus, especially a certain type of motor, has the unfortunate knack of utilising only a certain proportion, say, 80 per cent., of the current flowing through it. Such an installation would have a p.f. of 0.8. It must distinctly be understood that this does *not* mean that 80 per cent. of the power supplied is being usefully employed and the remainder going to waste. Exactly the same *amount* of current returns to the power house as left it on the outward journey, 80 per cent. of it having given up its energy and the remaining 20 per cent. returning unused.

Now, the greater the amount of current to be transmitted, the larger must be the cable through which its flows (just as in a water supply system the greater the amount of water required to flow through a pipe, the larger must be the diameter thereof). This means that a cable of greater section would have to be put down to supply a consumer having a low or bad p.f.—*i.e.*, with a large amount of "idle" current flowing—than would be necessary if his p.f. was high or good—*i.e.*, with very little idle current present.

The detrimental effects of bad p.f. are not confined to the cable systems, but apply also to the generating plant at the power house. An electricity generator capable of turning out 5,000 h.p. can only deliver 4,000 h.p. when connected to an industrial undertaking having a p.f. of 0.8, 20 per cent. of the current being "idle" and being returned to the power house having done no work. Consequently more generators have

to be installed with their attendant overhead charges. Thus it is seen, that if the power factor—or ratio of current consumed to that demanded—of a system is raised, the following economies are effected by the supplying authority:—

(*a*) Smaller and fewer cables with the necessary switchgear can be installed for a given load, or, conversely, more consumers can be connected to a given cable before necessitating laying a larger size of cable.

(*b*) Owing to the decreased amount of current flowing in the cables the "electrical friction," or transmission losses, are reduced.

(*c*) Less generating plant with its necessary switchboard connections and attendance is required for a given load and, therefore, less capital expenditure.

(*d*) Each generating set can be run under such conditions that it will deliver its maximum output of power and hence at its maximum efficiency.

There is also considerable advantage from the technical point of view in that when a p.f. is high the absence of large quantities of "idle" current in the system doing no work render the control of such a system much easier.

Thus it is seen that, in the case of two consumers each taking the same amount of *power*, the one with the low power factor is actually costing the supply authority far more than he with the higher power factor, and therefore in common fairness they should be charged on a system varying with the power factor.

Mr. R. Amberton.

If you buy a bar of metal and after turning it up to the shape you want you return the scrap and get credited with it at scrap prices, you will have paid for more metal than you actually use, but less than the price of the whole bar.

If you have an electric motor which only requires 15 effective amperes of electric current to run it, but actually takes 20 and returns 5, you will expect to pay for less than 20, but more than for 15.

Although your motor does not use up the extra 5 amperes, but returns it, the supply authority has to have big enough generators and cables, &c., to carry it. If your motor only took the net amount it needed, another consumer could be supplied to the extent of 5 amperes without increasing the size of the generating station or mains.

It is clear that if your motor takes 20 amperes and only uses 15, you have 5 amperes of idle current floating through your circuit. Power factor is the proportion of current effectively used to the total supplied. In the case mentioned, i.e., 15 useful out of 20 total, the power factor is easily seen to be three-quarters, or 0.75.

Electricity meters only measure useful current. To make them measure the total current passing would not be fair to the consumer, as he returns the unused part. A charge has to be made for the unused, or idle, current to cover the cost of delivering it and taking it back, and because of the extra size of generators and cables involved in doing this.

Although the supply authority makes an extra charge for bad-power-factor loads, it does not pay it. If your motor did not take the extra 5 amperes for which you only pay scrap value because you return it, it could have sold it at the full price to someone else.

The central station consists of a plant and a distributing system of a certain size, and the engineer wants to get full price for the whole output of the station. In practice this is not fully possible, but the better the power factor the greater the revenue on the capital value of the undertaking, and the lower the price at which electricity can be sold all round.

It is clear from the scale of charges that it will pay you to have a good power factor, and the supply engineer is equally anxious that you should. The principal ways of getting a good power factor are:—

(*a*) To install motors of the right kind.
(*b*) To install motors of the correct size (and not too large).
(*c*) To install power factor improving devices.

Free advice is obtainable from the station engineer at any time, together with a more detailed and technical explanation of power factor, if this is required.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Self-Contained Broadcast Radio Receiver.

An innovation has been put on the market by Messrs. L. McMICHAEL, LTD., Hastings House, Norfolk Street, Strand, W.C.2, in the form of a complete self-contained broadcast radio receiver. Hitherto it has not been possible to produce a really self-contained receiving set, owing to the fact that accumulators were necessary to operate the valves; the advent of the dull-emitter valve, however, has brought within the region of practical politics the operation of a number of valves by quite small light-weight batteries. Taking advantage of this Messrs. McMichael have introduced an instrument contained in a handsome oak cabinet, with folding doors in front, enclosing the panel. The set comprises the circuit known as M.H.B.R. 4, but a departure from their usual practice is that the valves are hidden, holes being provided in the panel in order to see that they are actually "alight." The valves are supported on a suitable frame, and a trap door is provided in the roof of the cabinet for their replacement. The batteries are contained in the base. The panel face is mottled or "mahoganite" finished, and all fittings are nickel plated. There are no visible wires or loose connections, and even those necessary for the aerial, earth, and loud speaker are provided with plugs. The M.H.B.R.4 circuit will receive all British broadcasting stations on a normal P.M.G. aerial and, in addition, by means of plug-in duolateral coils, most of the Continental stations, while switches enable the set to operate either one or more pairs of headphones, and sufficient volume is available on an ordinary loud speaker for out-door purposes.

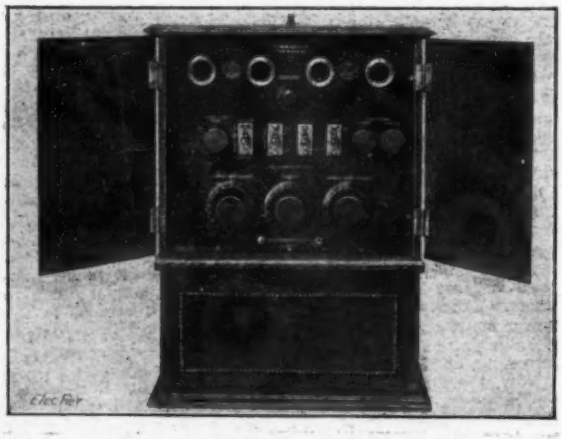


Fig. 1.—McMichael Radio Receiver.

The B.L.I.C. Taxicab Lighting Set.

THE BRITISH LIGHTING AND IGNITION CO., LTD., of Chesion Road, Aston, Birmingham, is making a feature of an electric lighting outfit for taxicabs, the requirements of which are not always identical with those of private cars in this respect. The equipment, which includes a belt-driven 8-A, 6-V dynamo, 60-Ah battery, cut-out, three-knob switchboard with an ammeter, two side lamps, a tail lamp, and a lamp for the taximeter, has been specially designed for the purpose it has to fulfil.

A New "Universal" Toaster.

Fig. 2 illustrates a new type of "Universal" electric toaster of which particulars have been sent us by MESSRS. L. G HAWKINS & Co., LTD., 116, Charing Cross Road, W.C.2. The appliance has a number of novel points; in the first place,

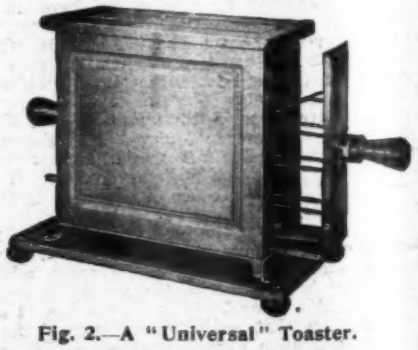
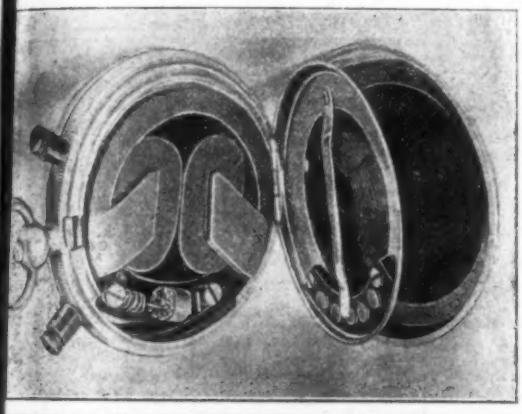


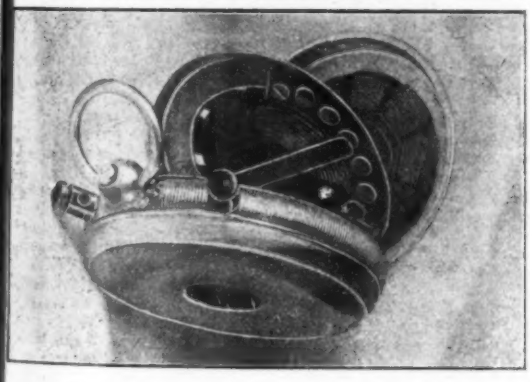
Fig. 2.—A "Universal" Toaster.

appearance is very different from the usual pattern, the vice partaking of the nature of a small electric oven. The ements are fixed in both sides of the toaster, and the bread placed in a sliding rack fitted with a crumb-catching device d a heat-insulated handle. By this means both sides of he bread are toasted at the same time, and, the heat being nserved by the oven-like structure, toasting is effected much ore rapidly than usual. The toaster has a highly-polished ickel finish.

A Watch Case Radio Receiver.

n invention which, although filed at the Patent Office over a ear ago, has just been accepted (patent No. 208,414), has for s object the provision of a complete radio receiving outfit, ncluding the necessary telephone receivers, in a small port- ble case. Mr. A. Page, B.Sc., of 19, Blythswood Drive, Glas- ow, is the patentee, and we are given to understand that he invention is not restricted to any particular details of con- truction, but covers all sets which contain the necessary com- ponents within one small case. In one of the models the case s a standard gentleman's silver watch case, and when not in se can be carried about in the waistcoat pocket. Two ter- minals are arranged on the outside for attaching the aerial





Figs. 3 and 4.—Interior of Watch-case Receiver.

and earth wires (see fig. 3), and as there are practically no connecting wires within, the self capacity of the set is extremely low. Earth connections are attached to the case with the result that by merely holding it in one's hand the earth is automatically completed through the body. Although a definite earth to the terminal provided will improve matters, still it can be dispensed with if inconvenient to obtain. The usual crystal detector, which is mounted on a concertina support to obtain as light a touch as possible, is used in conjunction with a silver "cat's whisker," and the magnet of the contained 'phones is made of cobalt-chrome steel. Although the steel employed weighs but an ounce, it is sufficiently powerful to lift a bar 1¼ lb. in weight. The soft iron pole pieces have a large contact surface with the steel, and the bobbins wound thereon contain a little more than 8,000 ohms resistance. A Stalloy diaphragm is employed and the distance between it and the soft iron pole pieces is 1/4,000 in. By unscrewing one screw and opening the front of the case the whole of the internal arrangement comes out, and when replaced the same definite air gap is always maintained. For tuning, an inductance coil is mounted on the back of the case, fig. 4, and another on the hinged flap which usually protects the works of the watch. A selective switch can cut out part of the coils and intermediate tuning can be effected by the variometer method of moving one coil relatively to the other. "Dead-end" effect is eliminated by earthing the end of the coils, which automatically short-circuits the turns not in use. Entire elimination of interference because of the close proximity of the earthed case and the tuning coils has been obtained by a special feature of the set. The efficiency of this little outfit is said to be remarkable.

Correspondence.

***Correspondents should forward their communications* at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Super-Pressure Cables.

In the technical Press during the past two years, references have repeatedly been made to British-manufactured cables suitable for voltages up to and including 66-kV working pressure, but very little detailed information appears to be forthcoming.

As the subject is necessarily one of interest to a large proportion of your readers, I crave the indulgence of your "Correspondence" columns to enable me to put a few direct questions to British cable manufacturers:—

(1) Can 66-kV triplex cable be regarded as a commercial proposition?

(2) Apart from short experimental lengths under test, is there any such cable in service? If so, please state location, length, and frequency.

(3) Has any British manufacturer yet installed 66-kV single-core cable?

(4) What test pressures are applied to such cables (2) and (3) at works (expressed as r.m.s. volts for a stated time, between phases and between line and earth?)

(5) What allowance would have to be made if the test were conducted at the maximum permissible temperature?

(6) What is the normal working stress in kV/cm?

(7) What is the nature of the dielectric?

The writer is aware of the composite line (*i.e.*, overhead and cable) under construction for 66 kV on the North-East Coast, referred to at the last Annual Convention of the I.M.E.A., and has also some experience of single-core cables in the testing of ironclad switchgear for 66 kV, but is under the impression that no such cable is yet in service.

William D. Owen.

Newcastle-upon-Tyne, *January 29th*, 1924.

Salesmanship.

During the past year or so, a great deal has appeared in the electrical journals regarding salesmanship, and there have also been conferences in London and elsewhere. The educational work in this direction has been mainly all to the good, but in one or two respects a certain amount of harm appears to have been done.

Emphasis has frequently been laid on certain points which the salesman must at all costs bear in mind, and which have now become traditional: "Create a good atmosphere," "Establish contact," "Create and sustain interest," "Dominate the interview," and so on.

Although a sales engineer, I also have occasion to be involved now and again in the purchase of plant, and then have an opportunity to view the other side of the matter. For example, I had occasion this week to see a representative who called regarding some machinery, worth perhaps £20,000, for which his firm had tendered. He greeted me, a perfect stranger, as a long-lost brother and wrung my hand affectionately (create a good atmosphere). He then went off at 60 miles an hour eulogising his firm's machinery (establish contact), and talked of the wonderful orders they had executed (sustain interest).

When I could get a word in edgeways, I raised one or two points about the design, and was informed that his firm always designed everything very liberally (tact). Before I could ask another question, he was rattling on again (dominate the interview). By this time I was thoroughly rattled myself, and asked him to make a note of three points and get his firm, which is quite a good one, to write me. He wrung me by the hand once more, promised faithfully to call next week, or sooner if required, and departed. Next week I shall be "out."

This sort of thing is splendid for rushing a prospective purchaser into buying a vacuum cleaner he really doesn't want, but when it is a case of being in the market for important plant, do let us have a little less "Salesmanship" and a lot more "Engineering."

The writer may have been unfortunate, but so far as his experience goes, the above style of interview appears to be the rule, rather than the exception, and it seems to be getting worse. Can this be due to "Salesmanship Conferences"?

M.I.Mech.E.

February 8th, 1924.

Two-way Pendant Switch Flexibles.

We have to thank Messrs. Lundberg & Sons and others for their interest in this matter, but assure them that the switches referred to were wired on the single-pole principle mentioned by them as being infallible. The present-day wireman knows of no other method.

A moment's thought, however, or the placing of their fingers across the terminals of a switch in the "off" position, will convince Messrs. Lundberg that both poles are necessarily present as long as the lamp remains on the holder. The resistance of this lamp being negligible compared with the dielectric resistance, the creeping current always present in some degree is approximately at full mains voltage.

This little point is overlooked by all supply authorities and Board of Trade regulations.

The word "short" should perhaps be qualified in the sense that it does not imply blowing of fuses, but only a permanent lighting of the lamp in the circuit, and ignition of the cord.

Reference to recent insurance disputes will convince Messrs. Lundberg that the fault we complain of has cost an insurance company many thousands of pounds.

Messrs. Lundberg & Sons have done much to increase the usefulness of electric circuits (and incidentally to complicate our wiring); can they not incur our further benediction by designing a simple two-way ratchet-action ceiling switch which will obviate the pendant live wire?

"Safety First."

February 1st, 1924.

[Such a switch was described in our issue of August 10th, 1923, p. 231.—EDS. ELEC. REV.]

As an interested reader of your valuable journal, I was glad to see the question of two-way switch flexibles raised by "Safety First."

As a contractor, may I say that I, too, have experienced the same trouble. In my case the flexible did not catch fire, but became red hot, the lamp lighting in due course, without the switches being on. I can vouch for the accuracy of the wiring as pointed out by your correspondents, Messrs. A. P. Lundberg & Sons, as I am well acquainted with their switching examinations, so that the trouble cannot be due to incorrect connections as suggested.

I should be glad to hear further views upon this interesting subject. Perhaps an expert might feel disposed to cast a little light upon the matter for the benefit of the trade, and an interested contractor.

W. H. S.

February 6th, 1924.

Costs and Selling Prices.

Your interesting leader in the issue of February 1st must be of great interest to all your readers, and in particular manufacturers. You advocate a principle of looking upon export trade as the equivalent of a power load on an electricity supply undertaking. In brief—lower prices for export.

It is extremely important that it should be known that this, in the eyes of the Dominions of Canada and Australia, is looked upon as dumping. Manufacturers are not allowed to sell their products to those countries at a price which is lower than the home market value. This Anti-Dumping Law is rigidly observed, and, as a matter of fact, is one of the greatest deterrents upon British export trade to the Dominions.

Ferranti, Ltd.
R. H. SCHOFIELD, *Sales Manager.*

Hollinwood, *February 5th*, 1924.

[We agree with our correspondent with regard to the adverse effect of the Anti-Dumping Law on British export trade with the Dominions. The matter was fully explained by Mr. W. G. Newberry in his articles on "Inter-Imperial Trade," published in our issues of June 29th and July 6th, 1923, and in his letter on "Preferential" Tariffs in our issue of August 31st, 1923.—EDS. ELEC. REV.]

Film-Cooling Towers, Ltd., v. Evans.

Your report of the above action in the issue of February 1st, whilst being a very fair report, omits one portion of Mr. Justice Astbury's remarks which is of some importance to myself as coming at the conclusion of all evidence given.

An official typescript of these remarks is as follows:—

Mr. Justice Astbury: "Before this case goes any further, I have heard both sides now, and may I say this? It is a very troublesome matter, because I feel that there is a great deal of suspicion about it in one sense. Mr. White has sworn positively that he knew nothing about it, whereas the last witness, Mr. Evans, who, I am bound to tell you, has given his evidence very fairly in my opinion, says that he told Mr. White all about it, and he gives the circumstances in which he told him, and he has told us how he told Mr. White and when he told him, and I think on the whole that his conduct is much more consistent with his having told Mr. White than with his not having told Mr. White. Detail work in connection with the patent was done perfectly openly in the office and—I am only just telling you—I dislike holding a man guilty of fraud and falsehood unless I am quite certain about it, and in this case I am not in the least satisfied, after having heard the defendant in the witness-box, that he was guilty of wrong in this matter. I ought to add that I think both parties blundered when the Mayor's Court action was settled."

Athol G. Evans.

North Finchley, *February 7th*, 1924.

Plumbing Joints.

On completing a wiped joint, a plumber goes through the ceremonial of anointing the wipe with tallow. Would someone please tell us, *pro bono publico*, what is the object of this ritual?

There seems to be considerable variety of opinion on the subject but one theory is that, in the past, it has been realised that wipes may occasionally be porous or cracked, and that the object of the tallow is to cover up these defects. If this is so, it would be useful to know how far it is successful and, if not, whether there is any other practicable alternative to it.

A year or two ago, one of the Institutions or Research Associations was understood to be undertaking an investigation into the whole subject of the composition and right methods of using plumbers' metal and fine solders. It would be helpful to industry generally if an authoritative statement could now be made as to the position of the work and if an interim or final report on the investigation could be published.

B. Welbourn.

Prescot, *February 8th*, 1924.

Squirrel-cage Motors of over 5 h.p.

The discussion *re* "Squirrel-cage Motors over 5 h.p." is opportune, and we thoroughly endorse "Motor Salesman's" view that the rule is antiquated and harmful to trade.

Unfortunately, this attitude has been maintained by the Wembley Exhibition authorities, who have discouraged the use of squirrel-cage-rotor motors by including this clause in their rules. Most exhibitors will have accepted it, and put in slip-ring motors. The few who have been enlightened enough to insist on using squirrel-cage motors have been told that special feeders must be run for this class of motor, and that the exhibitors must pay for it a charge of from £20 to £70. Under these circumstances, most non-electrical exhibitors will run their machinery with slip-ring motors.

Here is an exhibition costing millions, and the cables are not big enough to permit of a 10-h.p. squirrel-cage-rotor motor being started up!—at least that is what the authorities say. The probability is that the cables are big enough, the trouble lying solely in the minds of the rule makers. Several leading electrical manufacturers have loaned a 4,500-kW power house—and the authorities are not providing the cable to distribute the load properly.

The Wembley authorities probably do not feel that it matters much if slip-ring motors are insisted on: but it is a very serious matter. America has used squirrel-cage-rotor motors up to very large sizes for years, and American salesmen, trained to a belief in them, are offering them in British Colonies and oversea markets against British manufacturers. What impression will be made on the minds of the thousands of Colonial and other oversea customers who visit the Exhibition, when they find that the motor installation on exhibition stands smacks of the last century? The slip-ring motors on those stands will be built to most modern designs—and, thanks to so many good people insisting on them, the British slip-ring motor is second to none in the world—but who wants to be exhibiting a 10-h.p. slip-ring motor when the thing to use is a squirrel-cage motor? And the Americans will see that our oversea customers don't forget it.

"Then pay your money and show squirrel-cage-rotor motors," say the authorities. We shall do—we must if the authorities won't relax—but the harm is done to the whole British electrical trade, the fact being that whereas 90 per cent. of the motors in the Exhibition should be squirrel-cage, perhaps only 10 per cent. will be.

The Wembley Exhibition is being held to show the world how British manufacturers lead the world—and the authorities are doing all they can to bar out the simplest and cheapest form of electric motor known to the world to-day.

The Lancashire Dynamo & Motor Co., Ltd.
G. E. MASON, *Director.*

Manchester, *February 11th*, 1924.

The letter from Mr. R. Howe (London) in last week's issue is fairly typical of the arguments put up by Corporations against the use of squirrel-cage motors. This is the 1890 frame of mind that I complain about. He says that Corporations and power companies are in a different category, as the latter are out to sell power. That is the whole difference in a nutshell.

The power companies are out to supply cheap power, to expand their networks, and to develop trade. Cheap power

and squirrel-cage motors—what the manufacturers want to-day! Many Corporations are not out to sell power. As Mr. Howe says, they look ahead, but they look ahead for a quiet life, and they discourage a motor load because, if they develop it, they may have to put in bigger mains, and even increase the size of their generating plant. So they discourage the 50-ampere motor load for fear of the effect it will have on a 5-ampere lighting circuit, although it is a curious fact that in those places where large squirrel-cage motors are installed the lighting seems to get on all right.

It is evident that Mr. Howe is not deprecating squirrel-cage motors on Corporation mains; he is deprecating any motor load on his mains. This is obvious, because he writes of the effect on the power factor, and squirrel-cage motors as a class have a higher power factor than slip-ring motors.

Mr. E. W. Walker (Manchester) is much more broad-minded, but even he is rather behind the times when he states that machines having great inertia, such as shearing machines, should not be driven by s.c.r. motors. He hits on the very case where a properly designed s.c.r. motor should be used. Shearing machines are provided with a heavy flywheel, and should be driven by a motor the speed of which will fall at least 10 per cent. from no load to full load. Unless this is done, one never gets the benefit of the flywheel. Many people, compelled by their Corporation rules, have fitted slip-ring motors on shearing machines, and their ammeters show a pronounced kick every time the shears are operated. My advice to them is to put a resistance permanently in the rotor circuit in order to obtain 10 per cent. drop in speed on full load, and their kicks will disappear and their power bill decrease. The proper motor to use is an s.c.r. motor specially designed for shearing-machine work, that is, with 10 per cent. drop between no load and full load. This motor will drive the machine as it should be driven, getting the full benefit of the flywheel, and it can be started up by being thrown straight on the line, that is, if the power company is as broadminded as Mr. Walker is on this point; but, if not, it would start the machine nicely and easily with a star-delta starter.

Motor Sales Engineer.

February 11th, 1924.

The Registration of Electrical Contractors.

Your editorial and article on Registration are greatly appreciated by contractors. With encouragement and good-will from the Press and the other sections of the electrical industry, contractors will now be able to take a stand on firmer ground to the advantage of everyone, including the consumer.

Troughton & Young.
H. T. YOUNG.

London.
February 11th, 1924.

Legal.

Thefts of Electricity.

An electrical wiring contractor, John Calcott, of Blackpool, was fined £5 at Blackpool, on February 8th, for the theft of electricity. It was stated that in December last it was noticed that the consumption for defendant's house was small. A Corporation official requested Mrs. Calcott to switch on two or three lights, and it was then discovered that the radiator motor started working, showing that the lights were connected to it. When the official called later on, defendant was found with the floor boards up altering the wires. The meter cards showed that their had been no consumption for the first quarter; the lighting circuit was quite remote from the radiator circuit. The lighting rate was 4½d. per kWh, whereas the heating rate was only 1½d. It was alleged that the offence had been going on for 18 months.

Defendant said that two of the cables were connected in error to the heating, instead of to the lighting meter. The drop in the consumption was due to his changing over from 100-W to 20-W lamps.

At Gateshead-on-Tyne Police Court, on February 7th, Thomas Little, of Chopwell, a jeweller, was charged with having stolen electricity valued at 10s. from the Consett Iron and Coal Co., Ltd., between July, 1923, and January last. It was stated in evidence that the meter was taken out of defendant's shop, and the light was cut off, but subsequently the light was seen burning, and it was found that the supply had been connected up again. Defendant, who denied having connected up the wires, was fined £3 10s.

British Thomson-Houston Co., Ltd., v. British Insulated and Helsby Cables, Ltd.

The British Insulated and Helsby Cables, Ltd., have given notice of appeal against the judgment recorded against them in our last issue.

Tramway Accident Claim.

At Dublin, on February 6th, before the Lord Chief Justice and a common jury, Miss Ethel Timen, medical doctor, sought to recover damages from the Dublin United Tramway Co. for personal injuries, and consequential loss and damage, caused, as alleged, by the negligence of the defendants in the maintenance and management of a tramcar, whereby the plaintiff, who was travelling on a tramcar from Glasnevin towards Nelson Pillar on March 16th last, was struck violently on the head by the upright supporting the trolley pole. The defendants denied negligence. The jury found for the plaintiff, and assessed damages at £1,400. Sergeant Hanna asked for a stay of execution, and this was granted.

Charge of Forgery.

After a second day's hearing before the Stipendiary, at Wolverhampton last week, Peter Smith, aged 54, of Albert Road, Wolverhampton, managing director of the Efandem Co., Ltd., electrical engineers, was committee for trial to the Staffordshire Assizes, bail being allowed, on charges of forging and uttering bogus receipts and fraudulent conversion during the last five years.

There were originally 97 charges in the list, involving a sum of £300 6s., but at the close of the evidence the prosecution asked for a committal on 33 of them.

Reviews.

Elementary Steam-Power Engineering. By EDGAR MACNAUGHTON, M.E. Pp. viii+590; figs. 468. New York: John Wiley & Sons (Inc.). London: Chapman and Hall, Ltd. Price 25s. net.

It is as well to mention at the outset that this book hails from the United States, and that it is the result of the author's experiences while teaching what he terms "steam engineering." Herein lies a fundamental difference between American and British practice, and this difference colours the whole book and makes it, in our opinion, different from anything which has so far been published on this side. In our technical schools and engineering colleges the students have courses of lectures on "steam" or perhaps "steam engines," but it seldom, we believe, reaches the comprehensive dignity of "steam engineering." The result is that while the student acquires a profound knowledge of the theory and practice of steam reciprocating engines and steam turbines together, it may be, with a comprehensive idea of the different types of steam boilers and the theory of the production of steam, he has little or no idea of the functions of the essential auxiliary plant, the condensing apparatus, the feed-water arrangements, &c., and he is hopelessly lost when he finds himself in an up-to-date power house. The text-books on the subject—written usually by professors and lecturers—follow along the same lines, with the result that in them the problem is treated only from the point of view of the steam generator and the main engine. Mr. MacNaughton (we do not know if his methods are generally adopted in American engineering colleges) evidently prefers to treat the problem of power production by the use of steam as a whole, with the result that he has given us a comprehensive work in which, in addition to the usual chapters on boilers and engines, he includes chapters dealing with the various boiler auxiliaries, such as economisers, feed pumps, draught arrangements, and engine auxiliaries, such as air pumps, condensing plant, evaporators and the various small but essential details of every power station. The result is a work in which no phase of the equipment of an up-to-date steam power plant appears to have been omitted.

It must not, however, be imagined that this book is concerned merely with the practical side of the problem. As the material used has been based upon class-room lecture notes, it contains the usual theoretical work which forms part of the subject of steam engineering. Here again a departure is made from accepted practice, as the author places the practical side of his subject before the theoretical, and having, for example, described various types of steam turbines, he proceeds to give the usual elementary theories appertaining to them. This procedure is also adopted so far as is possible when dealing with the auxiliary plant, and brief explanations are given of the theories underlying the function and the operation of the auxiliary machinery. Another feature which adds considerably to the value of the book is the attention paid to the subject of testing the performance of the different parts of the power plant. The testing of boilers is particularly well done, the problems of flue gas temperatures, flue gas analysis, and calorimetry of the steam being treated in great detail. And what is of particular value is that the apparatus used, such as electrical pyrometers, steam calorimeters, Orsat gas apparatus, are described and illustrated so that the student is able to obtain a thorough grasp of the underlying principles governing the tests he has to carry out.

Sufficient has been said to indicate the scope of this book and to reveal the method of treatment which has been adopted. It remains only to be said that the student will find in it descriptions of plant which are usually found only in the technical Press, and which hitherto—in this

country at least—have not been considered of sufficient importance to warrant their inclusion in the pages of a textbook. In this connection, mention may be made of the chapters on furnaces and stokers, pipe systems and pipe accessories, feed-water heaters, economisers and feed-water treatment, as well as that on coal-handling equipment. We have a feeling that the author has dealt rather more comprehensively with the boiler equipment than he has with that of the engine, and certainly he falls into the prevailing error of dealing far too fully with the steam reciprocating engine at the expense of the steam turbine. In these days of turbo-generators there can be no excuse for devoting 163 pages to the reciprocating engine as against only 49 to the steam turbine, and while uttering words of criticism, may we not urge that the condenser and the air extraction apparatus are of such prime importance in the modern power station that they merit a very full and complete treatment, certainly far fuller than they get here. With these reservations, we have nothing but praise for this book. It is well produced, and the diagrams, particularly the perspective sectional drawings, have been prepared with great forethought as to the exact needs of the student. Of course, all the plant described and illustrated is American, and not infrequently it differs considerably from similar plant as used in this country, but the fundamental ideas are generally the same. At the end of each chapter a number of questions are appended, and these can all be answered in terms of British practice. For the student who is desirous of obtaining a complete knowledge of every phase of the problem of power production from steam instead of merely a knowledge of boilers and engines, and even for the electric power station engineer, this book should prove of the utmost value.

Elements of Storage Batteries. By C. M. JANSKY and H. P. WOOD, Professors of Electrical Engineering, University of Wisconsin Extension Texts (Industrial Education Series). University of Wisconsin, U.S.A. First Edition. Pp. x+241; figs. 148. New York and London: McGraw-Hill Publishing Co., Ltd, 1923. Price 12s. 6d. net.

This volume is one of the well-known Industrial and Engineering Education Textbooks, written by authorities on the various subjects, and developed and edited by the Dean of Studies (Mr. Louis E. Reber), University of Wisconsin Extension Division.

The volume under review is the first edition of an elementary textbook dealing with the principles, operation and the maintenance of storage batteries, together with a simple explanation of the electrical and chemical principles involved. The matter dealt with consists of (1) The Storage Cell, (2) Fundamental Electrical Quantities and Meters, (3) Chemistry of the Cell, (4) Nickel-Iron-Alkaline Cell, (5) Characteristics of Cells, (6) Charging of Storage Batteries, (7) Charging Circuits, (8) Testing of Cells and Circuits, (9) Maintenance of Storage Batteries, (10) Diseases of Batteries, (11) Uses of Commercial Batteries.

At the end of each chapter the editors have given a short general summary of the matter contained in the chapter. The lists of questions added to the various chapters do not appear to serve any useful purpose, and in a future edition the reviewer is of opinion that this feature might well be deleted without detriment from a book of this type.

The authors have written a book which outlines fundamental principles and essential chemical facts, and is designed mainly for the student and non-practical man. The scope of the work is clearly indicated in the title. Professors Jansky and Wood have endeavoured to provide the student with an introduction to the principles underlying storage batteries, emphasising those points which ensure the highest efficiency. A considerable amount of the book is devoted to the care and treatment of storage batteries.

A short but well-written chapter on "The Chemistry of the Storage Cell" is one of the chief features of the book. An interesting chapter is given on "The Commercial Batteries and their Uses," consisting more particularly of vehicle, train-lighting, farm-lighting and radio batteries.

The interest in the study of storage batteries and energy converters in general has increased in recent years, due to their wide applications in the service of man, and the publication of this text-book is well timed, being at a period of marked and extensive development in electricity, telegraphy and telephony.

The subject-matter of the book is clear and easy to read, in spite of being somewhat involved when dealing with the theoretical aspect of storage batteries.

There are but few typographical errors in the text, and the whole style of the book (binding, paper, printing and illustrations) is excellent. The illustrations help very materially to a clearer understanding of the subject-matter; many of the illustrations are from photographs of working drawings. The fairest comment that can be made on this book is that the authors have accomplished that which they set out to do, and technical science is indebted to them for a well-written textbook. The value of the work would be increased by the incorporation of a selected bibliography.

It is not expected that in a book of this type some errors would not creep in; these errors, however, are not serious. The book is an extremely useful one, and should find a place in every scientific library.

Anyone familiar with storage batteries will appreciate the service that has been rendered. E. L.

Published Specifications.

Compiled expressly for this journal by MESSRS. SEPTON-JONES, O'DELL AND STEPHENS, Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1922.

4,680. "Annunciator or signal particularly applicable for use as a [illegible] signal." J. C. Boyle. November 17th, 1922. (205,449.)

18,919. "Electric signalling systems employing periodic currents." S. F. Hinton. July 10th, 1922. (209,455.)

19,766. "Electric thermionic tubes." E. K. Hunter. July 19th, 1922. (209,775.)

24,810. "Electrical ignition devices for liquid-fuel furnaces." W. A. White. September 13th, 1922. (209,782.)

25,261. "Sound-reproducing machines." J. Harris. September 19th, 1922. (209,786.)

25,937. "Sparking plugs." W. P. Thompson (A. O. Hauzinger and S. E. Runciman). September 21st, 1922. (209,790.)

27,280. "Electric incandescent lamps." A. S. Sleebush. October 9th, 1922. (209,795.)

27,704. "Electric discharge tubes." General Electric Co., Ltd., and J. W. Ryde. October 12th, 1922. (209,800.)

28,054. "Electric distant control systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). October 16th, 1922. (209,815.)

28,078. "Telautography or phototelegraphy." H. G. Bartholomew and M. L. D. McFarlane. October 16th, 1922. (209,816.)

28,100. "Photo-electric device." T. W. Case. October 16th, 1922. (209,818.)

28,124. "Synchronisation of clocks by wireless waves." I. H. Parsons and A. E. J. Ball. October 17th, 1922. (209,823.)

28,152. "Electric heating device for use in connection with insulators and the like." G. W. Phipps. October 17th, 1922. (209,825.)

28,281. "Earthing of electrical apparatus." A. W. Williams and F. W. Rowley. October 18th, 1922. (209,831.)

28,322. "Vacuum tubes and the like." E. Y. Robinson. October 18th, 1922. (209,833.)

28,326. "Thermionic devices." E. Y. Robinson. October 18th, 1922. (209,834.)

28,474. "Magneto-electric ignition and lighting apparatus." G. Unger. December 19th, 1921. (190,451.)

28,488. "Electric motor-control systems." British Thomson-Houston Co., Ltd., R. D. Given, and E. G. James. October 19th, 1922. (209,841.)

28,694. "Speed-controlling system for motors and the like." British Thomson-Houston Co., Ltd. (General Electric Co.). October 21st, 1922. (209,850.)

28,831. "Method of, and means for, electrical operation of a typewriter carriage." J. D. Roots (J. R. Lyness). October 23rd, 1922. (209,853.)

29,209. "Electron discharge apparatus." Western Electric Co., Ltd., and H. Willson. October 26th, 1922. (209,861.)

29,443. "Oscillating electric motors." N. Shestopal. October 28th, 1922. (209,867.)

29,787. "Wave motors." O. H. Parsons. October 31st, 1922. (209,871.)

32,782. "Miners' combined electric and oil safety lamp." J. T. Whitehouse. December 1st, 1922. (209,909.)

32,944. "Transmission systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). December 2nd, 1922. (209,911.)

34,158. "Asynchronous induction machines with compensation of the phase displacement." Dr. T. Torda. May 10th, 1922. (Addition to 189,421 (197,640.)

34,316. "Asynchronous induction machines with compensation of the phase displacement." Dr. T. Torda. October 21st, 1922. (Addition to 204,294.) (205,778.)

1923.

150. "Loud-speaking telephones." S. M. Franses. November 21st, 1922. (207,487.)

241. "Underframes for tramway vehicles." Brush Electrical Engineering Co., Ltd., and W. E. Hall. January 3rd, 1923. (209,933.)

6,951. "Electric condensers." A. J. Stevens & Co. (1914), Ltd., and F. Stevens. March 10th, 1923. (209,986.)

7,114. "Electric furnaces or ovens." G. Schauly and L. Gernigon. March 12th, 1923. (209,988.)

10,271. "Electric circuit breaker." H. Cartier. May 9th, 1922. (187,966.)

15,528. "Lightning arresters and the like." K. McWhirr. June 16th, 1923. (210,014.)

16,029. "Electric discharge-tube illuminated sign devices." General Electric Co., Ltd. October 11th, 1922. (205,467.)

16,047. "Electric discharge-tube illuminated sign devices." General Electric Co., Ltd. February 15th, 1923. (Addition to 205,467.) (210,017.)

16,568. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). June 26th, 1923. (210,018.)

19,437. "Devices for protecting telephone, telegraph, and the like instruments against lightning or excessive electric potentials." A. E. Bent. July 30th, 1923. (Addition to 158,804.) (210,024.)

26,904. "Electric condensers." A. J. Stevens & Co. (1914), Ltd., and F. Stevens. March 10th, 1923. (Divided application on 209,986.) (210,030.)

27,044. "Electric controllers." H. V. James. October 20th, 1922. (210,031.)

Lighting Demonstration.—On the 6th inst. the third-year mechanical engineering students of the Regent Street Polytechnic School of Engineering visited the demonstration rooms of the Lighting Service Department of the British Thomson-Houston Co., Ltd., to hear an address and witness industrial and domestic lighting demonstrations. They were accompanied by Major T. Worswick, O.B.E., M.Sc., Director of Education, Mr. A. R. Horn, O.B.E., B.Sc., M.I.Mech.E., head of the school, and Mr. P. Kemp, M.Sc., M.I.E.E., head of the Electrical Engineering Department. The proceedings were conducted by Mr. W. E. Bush, manager of the Lighting Service Department, who, in an address and lecture, made comparisons between obsolete lighting systems and what is considered to be ideal lighting for industrial interiors. The evils of glare, the dangers of harsh shadows, and the benefits to be derived from good lighting were demonstrated. Demonstrations of this kind are appreciated by students at technical schools and colleges, since they can see the application of the technical details of illumination in a practical way.

The World Power Congress.—The Russian Committee Electrotechnical Council has decided to participate in the congress. Seven representatives are to be sent, and the papers which have been prepared, dealing with electrical questions and problems in Russia, are being translated into French.